The Glucose Balancing Act

Read how pancreatic hormones respond when blood glucose changes.

HAP.7.1 "Obtain, evaluate, and communicate information to illustrate that the endocrine glands secrete hormones that help the body maintain homeostasis through feedback mechanisms."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline what causes each hormone to be released, circle each hormone's effect, and number the steps that bring blood glucose back toward its usual range. Use your marks to trace each feedback loop.

After Lunch, Before Dinner

1. After a bowl of rice, glucose from digested starch enters your blood. Cells in the pancreas sense the rise and release more insulin, a hormone carried by the blood. Insulin helps muscle and fat cells take in glucose and helps the liver store glucose as glycogen. As blood glucose moves back toward its usual range, the pancreas releases less insulin. This is negative feedback: the response reduces the change that first triggered it. Without the decrease in insulin release, glucose could keep falling after the meal. Homeostasis means keeping conditions within a workable range, not holding them at one exact number.

2. Several hours later, a long walk uses glucose for energy while no new food is arriving. If blood glucose falls, other pancreatic cells release more glucagon. This hormone signals the liver to break down stored glycogen and release glucose into the blood. As blood glucose rises toward its usual range, glucagon release decreases. Insulin and glucagon have different effects, but both help prevent a large drift from the usual range. The pancreas does not wait for a person to think about hunger. Its hormone release changes in response to conditions inside the body, even during sleep.

3. Suppose a post online says, "The pancreas releases insulin at the same rate all day, so a meal cannot change hormone levels." The claim clashes with the meal sequence: rising glucose leads to more insulin, and returning glucose leads to less. To evaluate such a claim, look for measurements taken before eating, soon after eating, and later. Blood glucose readings alone would show a change but would not directly show insulin release. Paired glucose and insulin measurements could test whether their patterns match the proposed feedback loop. A pattern consistent with the loop supports it, although other factors can also affect glucose.

2 ANSWER WITH EVIDENCE

Use the passage

1. Trace the feedback loop that begins when glucose from the rice enters the blood. What causes insulin release to increase, what does insulin do, and what causes its release to decrease?

2. During the long walk, how does the pancreas respond if blood glucose falls? Explain why glucagon release later decreases.

3. A post claims that insulin release stays at the same rate after a meal. What measurements would help you evaluate the claim, and why are glucose readings alone not enough?

4. How do the insulin and glucagon feedback loops work together to keep blood glucose within a workable range?

3 YOUR TURN

Your own words

Imagine a person skips breakfast and then eats lunch. Explain how pancreatic hormone release could change at both times and how feedback limits each change. Name two measurements that could test your explanation.

ANSWER KEY

The Glucose Balancing Act

HIGH SCHOOL · HAP.7.1

PART 1 · READ AND MARK

Underline what causes each hormone to be released, circle each hormone's effect, and number the steps that bring blood glucose back toward its usual range. Use your marks to trace each feedback loop. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Trace the feedback loop that begins when glucose from the rice enters the blood. What causes insulin release to increase, what does insulin do, and what causes its release to decrease?	**Rising blood glucose causes the pancreas to release more insulin. Insulin helps cells take in glucose and the liver store it. As blood glucose returns toward its usual range, insulin release decreases.**
2	During the long walk, how does the pancreas respond if blood glucose falls? Explain why glucagon release later decreases.	**The pancreas releases more glucagon, which signals the liver to release glucose from stored glycogen. As blood glucose rises toward its usual range, glucagon release decreases.**
3	A post claims that insulin release stays at the same rate after a meal. What measurements would help you evaluate the claim, and why are glucose readings alone not enough?	**Measure both blood glucose and insulin before eating, soon after eating, and later. Glucose readings alone cannot directly show whether insulin release changes.**
4	How do the insulin and glucagon feedback loops work together to keep blood glucose within a workable range?	**Insulin helps lower blood glucose when it rises, while glucagon helps raise it when it falls. Release of each hormone decreases as glucose returns toward its usual range.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

If blood glucose falls while the person skips breakfast, the pancreas releases more glucagon. The liver then releases glucose, and glucagon release decreases as blood glucose rises toward its usual range. After lunch raises blood glucose, the pancreas releases more insulin, helping cells take in glucose and the liver store it; insulin release decreases as glucose returns toward its usual range. Paired measurements of blood glucose and each hormone over time could test this explanation.

Accept explanations that make the fasting response conditional on blood glucose falling. Students should identify blood glucose and hormone levels measured over time, with both insulin and glucagon included when testing both parts of their explanation.