Signals in Balance

Trace how hormones respond when body conditions change.

HAP.7 "Students will demonstrate an understanding of the major organs of the endocrine system and the associated hormonal production and regulation. Obtain, evaluate..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Read the passage, then underline each change the body detects, circle the hormone released in response, and number the steps that bring the condition toward its usual range.

After Rehearsal

1. At the end of a long rehearsal, Maya eats a banana. Digestion raises glucose in her blood, giving cells fuel. Cells in the pancreas detect the rise and release insulin. Insulin signals muscle and fat cells to take in more glucose and tells the liver to store glucose as glycogen. As blood glucose falls toward its usual range, the pancreas releases less insulin. Later, when Maya has not eaten for hours, low glucose triggers pancreatic cells to release glucagon. Glucagon tells the liver to release stored glucose. Each response weakens the change that started it, a pattern called negative feedback.

2. After rehearsal, Maya sweats on a hot bus ride. Losing water makes her blood more concentrated. Sensors in the hypothalamus detect this change, and the posterior pituitary releases antidiuretic hormone, or ADH, made in the hypothalamus. ADH tells the kidneys to return more water to the blood, so less water leaves as urine. Once blood concentration moves toward its usual range, ADH release decreases. This loop regulates water balance, not blood glucose. If Maya drinks a large bottle of water instead, lower blood concentration reduces ADH release, allowing the kidneys to produce more dilute urine.

3. A different loop sets Maya's longer-term energy use. The pituitary releases thyroid-stimulating hormone (TSH), which tells the thyroid gland to release T_3 and T_4. These hormones increase how quickly many cells use energy. Rising thyroid hormone levels signal the pituitary to release less TSH. In Graves' disease, antibodies stimulate the thyroid even when TSH is low, so excess thyroid hormone can speed the heart and raise energy use. In type 1 diabetes, immune damage to pancreatic insulin-producing cells prevents enough insulin release. Blood glucose may stay high despite the body's need to lower it.

2 ANSWER WITH EVIDENCE

Use the passage

1. Trace how the pancreas responds first after Maya eats and later when she has not eaten for hours. How does each response move blood glucose toward its usual range?

2. If Maya drinks a large bottle of water, how do ADH release and kidney activity change? Explain why this is negative feedback.

3. Why can the thyroid keep releasing too much hormone in Graves' disease even when TSH is low?

4. Compare the insulin response after eating in a person without diabetes and a person with type 1 diabetes. Why might glucose stay high in type 1 diabetes?

3 YOUR TURN

Your own words

Design a wearable helper for a person with type 1 diabetes. In 4 to 6 sentences, explain what it measures, what it does when glucose rises or falls, and one safety limit it must have.

Signals in Balance

PART 1 · READ AND MARK

Read the passage, then underline each change the body detects, circle the hormone released in response, and number the steps that bring the condition toward its usual range. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Trace how the pancreas responds first after Maya eats and later when she has not eaten for hours. How does each response move blood glucose toward its usual range?	**After she eats, the pancreas releases insulin, which promotes glucose uptake and storage, lowering blood glucose. When glucose is low, it releases glucagon, which prompts the liver to release stored glucose.**
2	If Maya drinks a large bottle of water, how do ADH release and kidney activity change? Explain why this is negative feedback.	**Lower blood concentration reduces ADH release. The kidneys return less water to the blood and produce more dilute urine, weakening the change caused by drinking water.**
3	Why can the thyroid keep releasing too much hormone in Graves' disease even when TSH is low?	**Antibodies stimulate the thyroid independently of TSH, so lowering TSH does not stop the excess thyroid hormone release.**
4	Compare the insulin response after eating in a person without diabetes and a person with type 1 diabetes. Why might glucose stay high in type 1 diabetes?	**Normally, rising glucose triggers insulin release, which helps cells take in glucose and the liver store it. In type 1 diabetes, damage to insulin-producing cells prevents enough insulin release, so glucose may remain high.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

My wearable would measure glucose repeatedly and show the readings to its user. When glucose rises above a set range, it could deliver insulin through a connected pump to help bring glucose down. When glucose falls, it would pause insulin delivery and alert the user to check the reading and take fast-acting carbohydrates if needed. It must alert the user if its sensor fails, because an incorrect reading could lead to an unsafe decision.

Accept accurate descriptions of negative feedback that identify the detected change, hormone response, and effect. For the design, accept other workable safety limits, but do not accept a device that delivers more insulin when glucose is falling.