Two Pancreatic Routes

Trace how digestion and hormones help regulate blood glucose.

HS-AP7-5 "Construct an explanation for maintaining blood sugar levels via endocrine and exocrine functions of the pancreas."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the exocrine steps that make glucose available from food. Circle the endocrine signals and their effects that bring blood glucose toward its usual range.

From Lunch to Later

1. At lunch, Maya eats a bowl of rice. Its starch cannot enter her bloodstream as whole starch molecules. The pancreas sends digestive fluid through a duct into the small intestine. This **exocrine** secretion contains amylase, an enzyme that breaks starch into smaller sugars. Enzymes in the intestine finish breaking those sugars into glucose, which passes through the intestinal wall into the blood. As a result, her blood glucose begins to rise. The exocrine pancreas helps make glucose available from food, but its digestive enzymes do not travel through the blood to tell cells when to take up glucose.

2. As Maya's blood glucose rises, beta cells in small clusters within the pancreas detect the change. These cells perform an **endocrine** function: they release insulin directly into the bloodstream. Insulin signals many body cells to take in more glucose and signals the liver and muscles to store glucose as glycogen. These actions lower blood glucose toward its usual range. As blood glucose falls, the signal for insulin release weakens. This is negative feedback: a change triggers responses that reduce that change. Unlike digestive enzymes, insulin reaches distant tissues through blood rather than through a duct.

3. Several hours later, Maya has not eaten again, but her brain and other cells still need glucose. When blood glucose falls, alpha cells in the pancreas release the hormone glucagon into the blood. Glucagon signals the liver to break down stored glycogen and release glucose into the bloodstream. As blood glucose rises toward its usual range, the signal for glucagon release weakens. These opposite endocrine responses help keep blood glucose within a workable range between meals. Exocrine digestion supplies glucose after food is eaten; endocrine signals control how much glucose remains available in the blood over time.

2 ANSWER WITH EVIDENCE

Use the passage

1. Explain how the pancreas helps Maya get glucose from rice. Why does amylase not tell her body cells to take up glucose?

2. After Maya eats, how does insulin reduce the change in her blood glucose? Trace the signal, its effects, and what happens to insulin release.

3. Hours after lunch, how does glucagon reduce the change in Maya's blood glucose? Trace the signal, its effect, and what happens to glucagon release.

4. Why would an explanation of Maya's blood glucose over the whole afternoon need both the exocrine and endocrine functions of the pancreas?

3 YOUR TURN

Your own words

A classmate says, “Insulin digests starch, and glucagon is only needed right after a meal.” Write one paragraph correcting both claims using a snack of crackers followed by several hours without food. Explain where the pancreatic enzyme and hormones travel and how the hormone responses help keep blood glucose in range.

ANSWER KEY

Two Pancreatic Routes

HIGH SCHOOL · HS-AP7-5

PART 1 · READ AND MARK

Underline the exocrine steps that make glucose available from food. Circle the endocrine signals and their effects that bring blood glucose toward its usual range. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Explain how the pancreas helps Maya get glucose from rice. Why does amylase not tell her body cells to take up glucose?	**Pancreatic amylase travels through a duct to the small intestine and breaks rice starch into smaller sugars. Intestinal enzymes finish making glucose, which enters the blood. Amylase is a digestive enzyme, not a hormone carried in blood to signal body cells.**
2	After Maya eats, how does insulin reduce the change in her blood glucose? Trace the signal, its effects, and what happens to insulin release.	**Rising blood glucose triggers beta cells to release insulin into the blood. Insulin promotes glucose uptake and storage, lowering blood glucose. As it falls, the signal for insulin release weakens.**
3	Hours after lunch, how does glucagon reduce the change in Maya's blood glucose? Trace the signal, its effect, and what happens to glucagon release.	**Falling blood glucose triggers alpha cells to release glucagon into the blood. Glucagon signals the liver to release glucose from stored glycogen. As blood glucose rises, the signal for glucagon release weakens.**
4	Why would an explanation of Maya's blood glucose over the whole afternoon need both the exocrine and endocrine functions of the pancreas?	**Exocrine secretion helps digest the rice starch so glucose can enter the blood. Endocrine insulin helps lower blood glucose after lunch, while glucagon helps raise it when glucose falls later.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

After someone eats crackers, pancreatic amylase travels through a duct to the small intestine, where it helps break starch into smaller sugars. Intestinal enzymes complete digestion, and glucose enters the blood. Insulin does not digest starch: beta cells release it into blood when glucose rises, and it promotes glucose uptake and storage, lowering blood glucose. Hours later, if blood glucose falls, alpha cells release glucagon into blood. It signals the liver to release glucose from glycogen, raising blood glucose. As each change is reduced, the signal to release the corresponding hormone weakens.

Accept explanations that distinguish enzyme delivery through a duct from hormone delivery through blood and connect insulin and glucagon to opposing negative-feedback responses. Students need not name every intestinal enzyme.