Signals in Balance

Trace how nerve signals and hormone pathways regulate the body.

HAP.6 "Construct an explanation of how the interdependence of the nervous and endocrine systems maintains homeostasis. a. Obtain, evaluate, and communicate information explaining how hormones secreted by endocrine glands help the body maintain..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the fast nervous response, circle hormone names, and label each example of feedback N for negative or P for positive. Use your marks to trace how the signals help maintain internal balance.

From a Cold Track to a Hormone Surge

1. At a winter track meet, a runner starts shivering before the race. Temperature sensors in the skin and brain send information to the hypothalamus, a brain region that links nervous and endocrine activity. Its nerve circuits can trigger fast responses such as shivering. For longer-lasting adjustments, the hypothalamus releases TRH, which signals the pituitary gland to release TSH. TSH prompts the thyroid gland to release thyroid hormones. These hormones influence how quickly cells use energy and produce heat. The same brain region thus helps coordinate rapid nerve signals with slower hormone signals to protect internal conditions.

2. Suppose thyroid hormone levels rise above the body's usual range. The hypothalamus releases less TRH, and the pituitary releases less TSH. With less TSH stimulation, the thyroid releases less hormone. If thyroid hormone levels fall, TRH and TSH release can increase. This is negative feedback: a change in hormone level sets off responses that oppose the change. The hypothalamus and pituitary also form a separate pathway to the gonads. The hypothalamus releases GnRH, prompting the pituitary to release LH and FSH. These hormones act on ovaries or testes, supporting sex hormone production and reproductive development.

3. In testes, LH promotes testosterone production, while FSH supports sperm production. In ovaries, FSH helps follicles develop, and LH helps trigger ovulation. Sex hormones can reduce GnRH, LH, and FSH release through negative feedback, limiting further stimulation. Yet during part of the menstrual cycle, sustained high estrogen from a developing follicle causes a surge of LH. This temporary positive feedback amplifies the signal and helps trigger ovulation. Afterward, the surge ends. By responding to signals from the nervous system and to changing hormone levels, these linked pathways help regulate metabolism, puberty, and reproduction without relying on one gland alone.

2 ANSWER WITH EVIDENCE

Use the passage

1. At the track meet, how do the nervous and endocrine systems provide responses on different time scales?

2. If thyroid hormone levels rise above the usual range, trace the signals that bring them back down.

3. How can signals from the hypothalamus and pituitary affect both reproductive development and sperm production?

4. Why is the LH surge before ovulation positive feedback rather than the negative feedback described for thyroid hormones?

3 YOUR TURN

Your own words

Imagine the pituitary stops releasing both TSH and LH/FSH, even when the hypothalamus sends signals. In four sentences, explain likely effects on metabolism and reproduction, and why signals from the hypothalamus alone cannot restore these hormone pathways.

Signals in Balance

PART 1 · READ AND MARK

Underline the fast nervous response, circle hormone names, and label each example of feedback N for negative or P for positive. Use your marks to trace how the signals help maintain internal balance. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	At the track meet, how do the nervous and endocrine systems provide responses on different time scales?	**Temperature information reaches the hypothalamus, whose nerve circuits can trigger shivering quickly. Its TRH signal begins a slower pathway through the pituitary and thyroid that influences energy use and heat production.**
2	If thyroid hormone levels rise above the usual range, trace the signals that bring them back down.	**The hypothalamus releases less TRH, so the pituitary releases less TSH. With less TSH stimulation, the thyroid releases less thyroid hormone.**
3	How can signals from the hypothalamus and pituitary affect both reproductive development and sperm production?	**The hypothalamus releases GnRH, which prompts the pituitary to release LH and FSH. These hormones act on the testes, supporting testosterone production and sperm production.**
4	Why is the LH surge before ovulation positive feedback rather than the negative feedback described for thyroid hormones?	**Sustained high estrogen causes an LH surge that amplifies the signal and helps trigger ovulation. In the thyroid pathway, high thyroid hormone instead reduces the signals that stimulate its release.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Without TSH, the thyroid receives less stimulation, so thyroid hormone levels could fall and cells could use energy more slowly. Without LH and FSH, the gonads receive less stimulation, which could disrupt sex hormone production and processes such as sperm production or ovulation. The hypothalamus may continue sending signals as hormone levels fall. Those signals cannot restore either pathway if the pituitary does not release the hormones needed to stimulate the thyroid and gonads.

Accept responses that distinguish a rapid nervous response from a slower endocrine pathway and trace signals in the correct direction. For the open task, accept either ovaries or testes as the reproductive example.