Signals and Switches

Trace hormone routes and the feedback that changes them.

HS-AP7-3 "Compare and contrast the hormones of the hypothalamus-pituitary complex. Analyze the function of each hormone and connect them to feedback signals for the gonads, thyroid, and adrenal cortex."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle the first mention of each hypothalamic signal, underline the first mention of each anterior pituitary signal, and number the three target-gland hormone groups to trace what each route feeds back to.

Three Routes, One Control Center

1. In a busy control center, one message can set off a chain of others. The hypothalamus sends releasing hormones through tiny blood vessels to the anterior pituitary. Its TRH prompts release of TSH, CRH prompts ACTH, and pulses of GnRH prompt LH and FSH. These anterior pituitary hormones travel in the bloodstream to glands elsewhere in the body. The posterior pituitary works differently: it releases ADH and oxytocin made in the hypothalamus, rather than making the signals that direct the thyroid, adrenal cortex, and gonads. Knowing where a signal starts helps explain what happens when its target changes.

2. When a person steps into cold air, thyroid hormone helps cells use energy and generate heat. Along the thyroid route, TRH from the hypothalamus leads to TSH from the anterior pituitary; TSH stimulates the thyroid to release T_3 and T_4. During a stressful event, CRH leads to ACTH, which stimulates the adrenal cortex to release cortisol. Cortisol helps the body make fuel available. Both routes use a hypothalamic signal and an anterior pituitary signal, but their target glands and effects differ. Rising thyroid hormone reduces TRH and TSH; rising cortisol reduces CRH and ACTH.

3. The gonad route has a different pattern at the pituitary. Pulses of GnRH cause the anterior pituitary to release both LH and FSH, which act on the ovaries or testes. LH and FSH support egg or sperm development and the production of sex hormones, including estrogen, progesterone, and testosterone. These hormones usually reduce GnRH, LH, and FSH by negative feedback; inhibin from the gonads particularly reduces FSH. A brief exception occurs before ovulation: sustained high estrogen can trigger a surge of LH through positive feedback. Unlike the thyroid and adrenal routes, this route has two major pituitary signals and sometimes switches feedback direction.

2 ANSWER WITH EVIDENCE

Use the passage

1. Compare the thyroid and adrenal cortex routes. Name the hypothalamic signal, anterior pituitary signal, and target-gland hormone in each route.

2. How does feedback from the gonads differ from feedback from the thyroid? Include the special effect of inhibin.

3. Compare the usual effect of sex hormones on pituitary signals with the effect of sustained high estrogen before ovulation.

4. How is the posterior pituitary's role different from the anterior pituitary's role in the three routes?

3 YOUR TURN

Your own words

Two patients have low thyroid hormone. In Patient A, the thyroid cannot make enough hormone; in Patient B, the anterior pituitary cannot release enough TSH. In four or five sentences, predict how TRH and TSH would differ between the patients and explain the feedback behind your predictions.

Signals and Switches

PART 1 · READ AND MARK

Circle the first mention of each hypothalamic signal, underline the first mention of each anterior pituitary signal, and number the three target-gland hormone groups to trace what each route feeds back to. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Compare the thyroid and adrenal cortex routes. Name the hypothalamic signal, anterior pituitary signal, and target-gland hormone in each route.	**Thyroid: TRH leads to TSH, which stimulates T_3 and T_4 release. Adrenal cortex: CRH leads to ACTH, which stimulates cortisol release.**
2	How does feedback from the gonads differ from feedback from the thyroid? Include the special effect of inhibin.	**Thyroid hormones reduce both TRH and TSH. Gonadal sex hormones usually reduce GnRH, LH, and FSH, while inhibin particularly reduces FSH.**
3	Compare the usual effect of sex hormones on pituitary signals with the effect of sustained high estrogen before ovulation.	**Sex hormones usually reduce LH and FSH through negative feedback. Before ovulation, sustained high estrogen instead triggers an LH surge through positive feedback.**
4	How is the posterior pituitary's role different from the anterior pituitary's role in the three routes?	**The anterior pituitary releases TSH, ACTH, LH, and FSH to direct the target glands. The posterior pituitary releases ADH and oxytocin made in the hypothalamus; it does not release the signals that direct those three glands.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

In Patient A, low thyroid hormone weakens negative feedback, so TRH and TSH should both rise. The anterior pituitary responds to TRH, but the thyroid cannot make enough hormone in response to TSH. In Patient B, low thyroid hormone should raise TRH, but TSH stays low because the anterior pituitary cannot release enough of it. Both patients have low thyroid hormone, but only Patient A has a pituitary that can raise TSH.

Accept predictions of high TRH in both patients, high TSH in Patient A, and low TSH in Patient B. Responses should connect low thyroid hormone to reduced negative feedback and distinguish the gland that cannot respond in each patient.