15.5A: Control of Hormone Secretion

A hormone is a molecule released by a cell or a gland in one part of the body that exerts effects via specific receptors at other sites.

LEARNING OBJECTIVES

Describe the manner in which hormone secretion in the endocrine system is controlled

KEY TAKEAWAYS

Key Points

- The endocrine system relies on feedback mechanisms to control the hormone levels in the circulatory system.
- Negative feedback systems prevent deviation from an ideal mean to maintain homoeostasis.
- Positive feedback systems facilitate deviation from the mean.

Key Terms

- **negative feedback**: A system that prevents deviation from a mean value.
- **positive feedback**: A system that promotes deviation from a mean value.

The physiological activity of a hormone depends largely on its concentration within the circulatory system. The effects of too high or too low a concentration of hormones can be damaging—this level must be tightly controlled.
The endocrine system relies on feedback systems to regulate hormone production and secretion.

**Negative Feedback**

Most endocrine glands are under negative feedback control that acts to maintain homoeostasis, i.e., prevent deviation from an ideal value. A key example of a negative feedback system is the regulation of the thyroid hormone thyroxine, which regulates numerous key metabolic processes.

Briefly, neurons in the hypothalamus secrete thyroid-releasing hormone that stimulate cells in the anterior pituitary to secrete thyroid-stimulating hormone. The thyroid-stimulating hormone then stimulates the release of thyroxine from the thyroid gland.

When the blood concentration of thyroxine rises above the ideal value as detected by sensory neurons, the hypothalamus is signaled to stop thyroid-releasing hormone production, which eventually lowers the levels of thyroxine in the blood. When these drop below the ideal value the hypothalamus is signaled to begin secreting thyroid-releasing hormone again.

**Positive Feedback**

Positive feedback mechanisms control self-perpetuating events, that is, they encourage deviation from the mean. Positive feedback systems are much less common although they do exist. A key example occurs during childbirth.

The hormone oxytocin is produced by the posterior pituitary that stimulates and enhances contractions during labor. During birth, as the baby moves through the birth canal, pressure receptors within the cervix signal the hypothalamus to stimulate the pituitary to secrete oxytocin.

Oxytocin travels to the uterus through the bloodstream, stimulating the muscles in the uterine wall to contract which in turn increases the activation of the pressure receptors and stimulates further release of oxytocin. The strength of muscle contractions intensifies until the baby is born and the stimulation of the pressure receptors is removed, which stops the release of oxytocin.