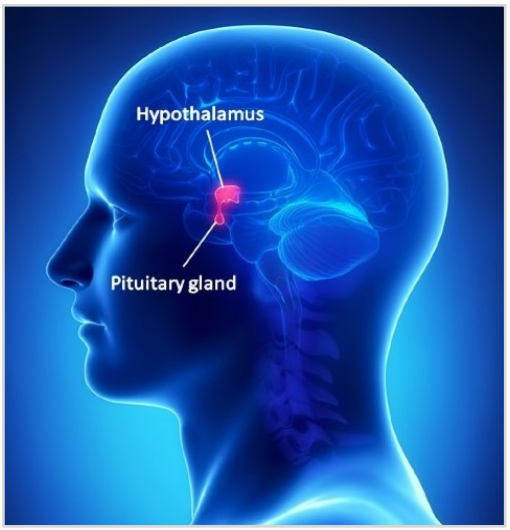
Hypothalamus
Fact Sheet

Location

The hypothalamus is an area of the brain (about 3.5 cm long) that links the brain to the endocrine system.

The hypothalamus sits at the base of the brain and is connected to the pituitary gland by a stalk made of both nerves and blood vessels. Most hormones made by the hypothalamus are carried through this stalk to the pituitary.



Functions/Roles

The hypothalamus is the main link between the endocrine and nervous systems. Its key function is to produce hormones that keep the body in a stable condition, called homeostasis. It does this by coordinating the messages and signals received from other glands (hormones) with those from the brain (nerve impulses).

Together, the hormones made by the hypothalamus directly or indirectly regulate:

- Body temperature
- Sleep and alertness
- Appetite and body weight
- Thirst
- Daily (circadian) rhythms
- Blood pressure and heart rate
- Sex drive
- Learning and memory
- Mood
- Sickness behaviours (fatigue, fever, loss of appetite).

Hormones produced by the hypothalamus

Oxytocin helps the uterus contract and the cervix to dilate in childbirth. It is also important for breastfeeding, where it causes milk to move into the breast, commonly known as the "let-down" response. Oxytocin also plays roles in helping a mother and baby bond, social interaction and anxiety. Oxytocin is made in the hypothalamus and transported to the back part (posterior) of the pituitary gland, where it is stored until needed.

Anti-Diuretic Hormone (ADH) (or vasopressin) signals the kidneys to pass less water into the urine. This helps keep enough water in the body to function normally and avoid dehydration. ADH also narrows (constricts) the blood vessels, which causes an increase in blood pressure. ADH is made in the hypothalamus and transported to the back part (posterior) of the pituitary gland where it is stored until needed.

Corticotrophin Releasing Hormone (CRH) signals the pituitary gland to make adrenocorticotrophic hormone (ACTH).

Thyrotrophin Releasing Hormone (TRH) signals the pituitary gland to make thyroid stimulating hormone (TSH).

Gonadotrophin Releasing Hormone (GRH) signals the pituitary gland to make Follicle Stimulating Hormone (FSH) and Luteinising Hormone (LH).

Growth Hormone Releasing Hormone signals the pituitary gland to make growth hormone (GH).

Somatostatin signals the pituitary gland to make less growth hormone (GH).

Dopamine is a chemical released from nerve cells in the hypothalamus, which acts on other endocrine organs. Dopamine signals the pituitary gland to stop releasing prolactin.

Hormones Australia aims to improve the health of Australians through increasing understanding about hormones and hormone-related conditions. Hormones Australia is an initiative and governed by the Endocrine Society of Australia (ESA).

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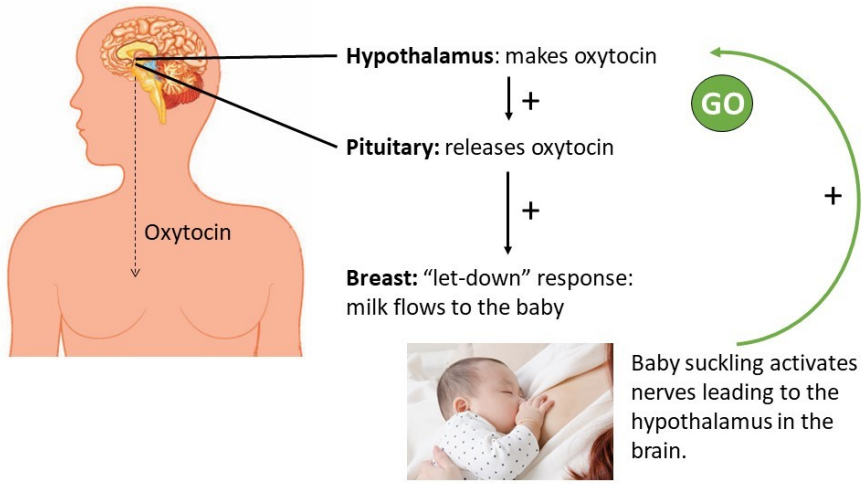
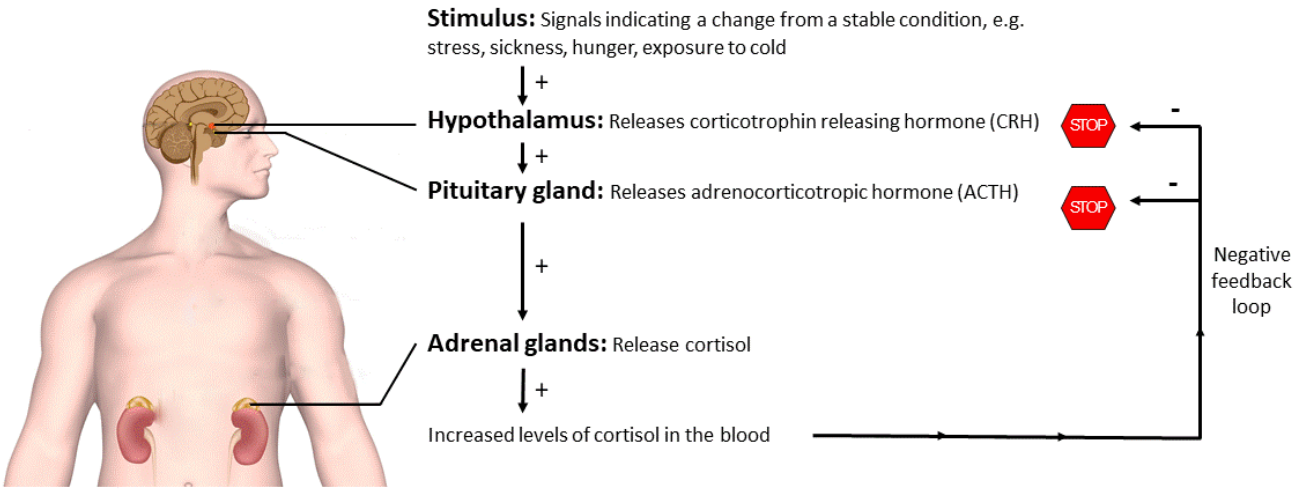
Keeping hypothalamic hormones in balance

Anti-Diuretic Hormone (ADH) is controlled by a negative feedback loop. The hypothalamus increases ADH when there is too much salt or electrolytes in the blood, or when blood pressure or volume falls. When the hypothalamus senses that salt concentrations and blood pressure have returned to normal, it makes less ADH.

Oxytocin is controlled through a positive feedback loop. Oxytocin starts to be made when nerves leading to the hypothalamus are activated. This occurs when a baby starts to suckle at the breast. As the baby feeds, the nerves in the breast signal to the hypothalamus to release oxytocin. More and more oxytocin is released until the nerves stop signalling when the baby finishes feeding.



Corticotrophin Releasing Hormone (CRH) is controlled through a negative feedback loop. CRH from the hypothalamus signals the pituitary gland to make adrenocorticotrophic hormone (ACTH). ACTH then signals the adrenal glands to make glucocorticoid hormones. The major glucocorticoid hormone is cortisol. This system is called the hypothalamic pituitary adrenal axis (or HPA axis). Cortisol travels through the blood and is recognised by the hypothalamus and pituitary gland. When a threshold is reached, cortisol signals to the hypothalamus and pituitary to make less CRH and ACTH. The HPA axis is the main system activated in response to stress.



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Thyrotrophin Releasing Hormone (TRH) is controlled through a negative feedback loop. TRH from the hypothalamus signals the pituitary gland to make thyroid stimulating hormone (TSH). TSH then signals the thyroid to make thyroid hormones. These hormones travel through the blood and are recognised by the hypothalamus and pituitary gland. When a threshold is reached, the hypothalamus makes less TRH and the pituitary makes less TSH.

Gonadotrophin Releasing Hormone (GnRH) is controlled through a negative feedback loop. GnRH from the hypothalamus signals the pituitary gland to make luteinising hormone (LH) and follicular stimulating hormone (FSH). In men, LH and FSH signal the testes to produce testosterone. In women, LH and FSH signal the ovaries to make estrogen and progesterone. When these hormones reach a threshold level, the hypothalamus makes less GnRH.

Growth Hormone Releasing Hormone (GHRH) and Somatostatin work together to control growth hormone (GH) levels. Growth hormone releasing hormone signals the pituitary gland to release growth hormone. Neurons (nerve cells) in the hypothalamus monitor growth hormone levels. When levels are high, the hypothalamus releases somatostatin which signals the pituitary gland to make less growth hormone. These
two hormones rise

Common problems and conditions of the hypothalamus

Tumours of the hypothalamus can result in altered hormone production and release. Because these hormones are important messenger signals for other glands in the endocrine system, this can lead to endocrine problems or conditions, e.g. Growth Hormone deficiency.