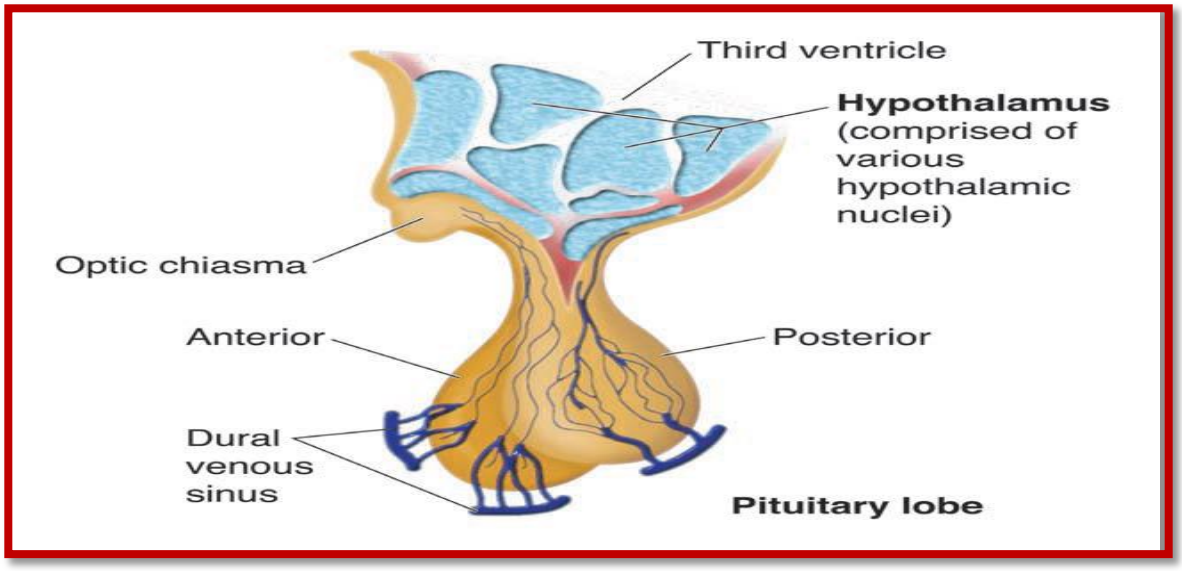
Hypothalamus:

The hypothalamus is located near the center of the brain, above the brainstem and below the cerebrum composed of many small nuclei with diverse functions. Located above the midbrain and below the thalamus, the hypothalamus makes up the ventral diencephalon. The diencephalon is an embryologic region of the vertebrate neural tube that gives rise to posterior forebrain structures. By synthesizing and secreting neurohormones, the nuclei of the hypothalamus act as a conduit between the nervous and endocrine systems via the pituitary gland (hypophysis), regulating homeostatic functions such as hunger, thirst, body temperature, heart rate, blood pressure, and contractions of the urinary bladder.



This diagram shows the hypothalamus and pituitary glands. The pituitary is attached to the underside of the brain at the hypothalamus by a thin stalk. The anterior pituitary receives blood that contains controlling factors directly from the hypothalamus. These factors either stimulate or inhibit the release of pituitary hormones. The posterior pituitary is controlled by nerves from the hypothalamus.

Hormones that are released by the hypothalamus

Special neurons in the hypothalamus synthesize and secrete the ***hypothalamic releasing*** and ***inhibitory hormones*** that control secretion of the anterior pituitary hormones. These neurons originate in various parts

of the hypothalamus and send their nerve fibers to the ***median eminence*** and ***tuber cinereum***, an extension of hypothalamic tissue into the pituitary stalk. The endings of these fibers are different from most endings in the central nervous system, in that their function is not to transmit signals from one neuron to another but rather to secrete the hypothalamic releasing and inhibitory hormones into the tissue fluids. These hormones are immediately absorbed into the hypothalamic-hypophysial portal system and carried directly to the sinuses of the anterior pituitary gland.

The major Hypothalamic Releasing and Inhibitory Hormones Control Anterior Pituitary Secretion.

1. ***Thyrotropin-releasing hormone*** **(TRH),** which causes release of thyroid-stimulating hormone
2. ***Corticotropin-releasing hormone*** **(CRH)**, which causes release of adrenocorticotropin
3. ***Growth hormone–releasing hormone*** **(GHRH),** which causes release of growth hormone, and ***growth hormone inhibitory hormone*** **(GHIH),** also called ***somatostatin,*** which inhibits release of growth hormone.
4. ***Gonadotropin-releasing hormone*** **(GnRH),** which causes release of the two gonadotropic hormones, luteinizing hormone and follicle-stimulating hormone
5. ***Prolactin inhibitory hormone*** **(PIH),** which causes inhibition of prolactin secretion.

There are some additional hypothalamic hormones, including one that stimulates prolactin secretion and perhaps others that inhibit release of the anterior pituitary hormones.

THE PITUITARY GLAND:

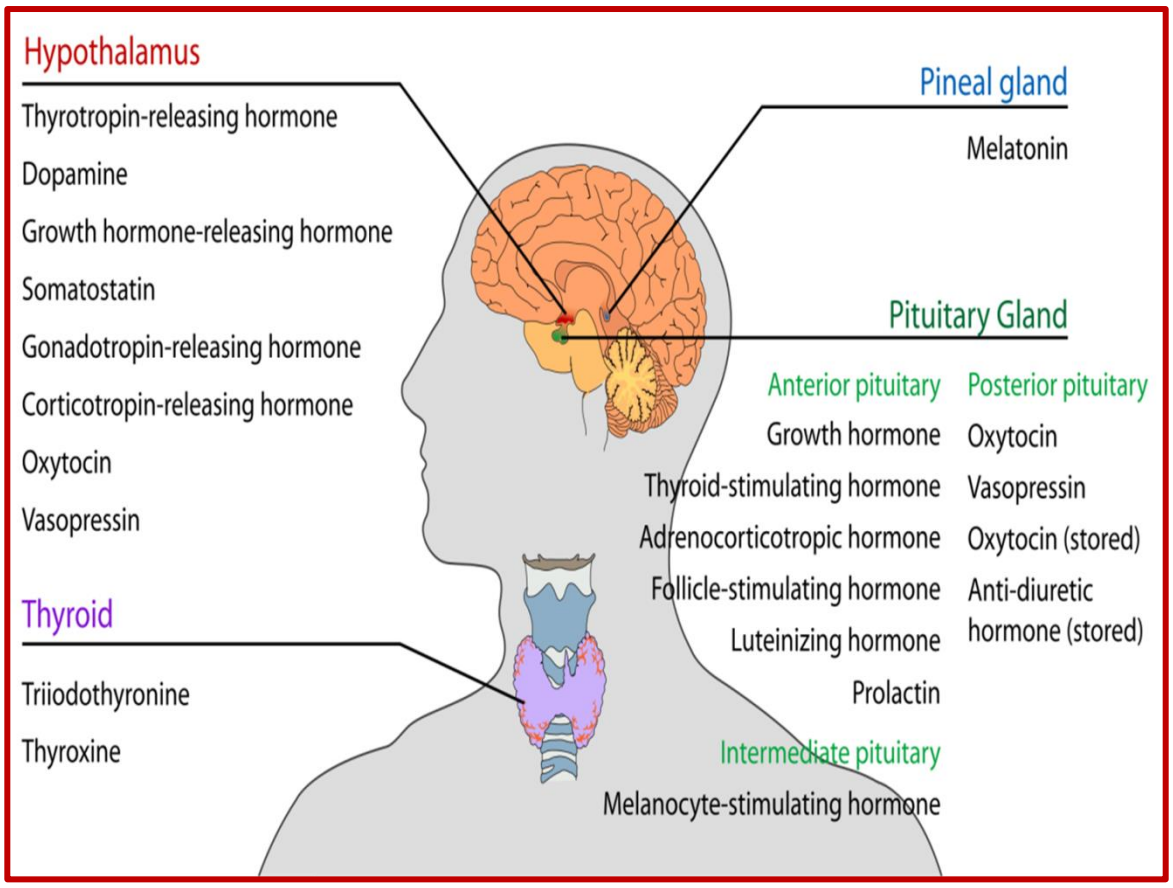
is attached to the underside of the brain by a slender stalk. The pituitary gland, also called the **hypophysis,** it sits in a pocket of bone called the ***sella turcica*** which is located directly above the palate of

the mouth and behind the bridge of the nose. It arises from two different tissue sources:

Posterior pituitary is nervous tissue (**neurohypophysis**) and **Anterior pituitary** is glandular (**adenohypophysis**).

Posterior pituitary -is the neural portion derived from an extension of the hypothalamus (median eminence) which remains connected throughout life by a stalk, called the infundibulum.

Anterior pituitary – is the glandular portion derived from the mouth epithelium (Rathke's pouch) .It forms a cuff (pars tuberalis) around the infundibulum.



The following hormones are released by the anterior pituitary:

1. **Growth Hormone** stimulates bone and muscle cells to grow.
2. **Prolactin** causes the mammary glands to produce milk.
3. **Follicle Stimulating Hormone (FSH)** and **Luteinizing**

Hormone (LH), known collectively as **gonadotropins,** stimulate hormone and gamete production by the **gonads (testes and ovaries).**

4. **Thyroid Stimulating Hormone (TSH)** causes the thyroid to produce thyroid hormone.
5. **Adrenocorticotropic Hormone (ACTH)** stimulates the adrenal cortex to produce corticosteroids, especially during periods of stress.
6. **Melanocyte Stimulating Hormone (MSH)** may have a role in fat metabolism.
7. **Endorphins,** which are also produced by the brain, reduce the perception of pain.

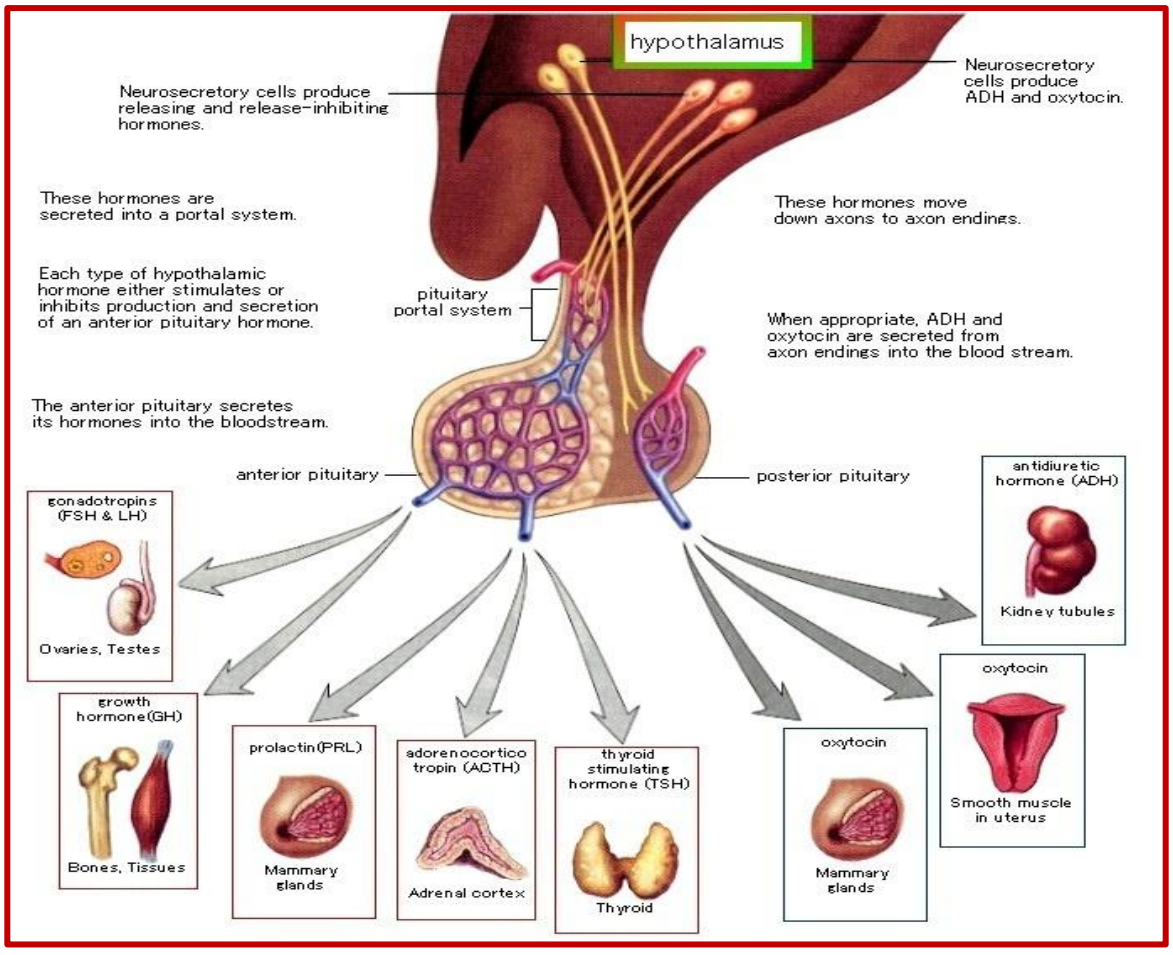
The posterior pituitary:

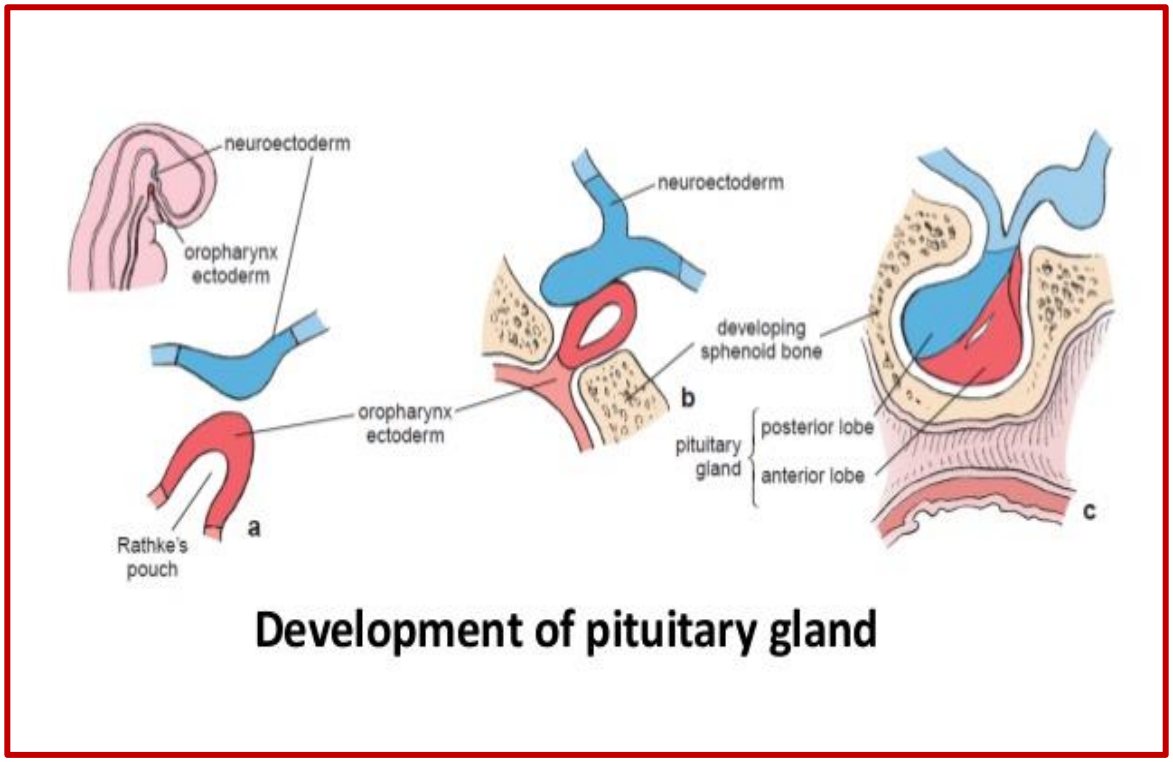
is an extension of the brain. It releases two hormones—**oxytocin** and **antidiuretic hormone (ADH)**—that are made in specialized cells in the **hypothalamus**.

The hormones are transported down nerve cells into the pituitary, where they are stored. The hypothalamus signals for their release by direct nerve signals to allow for quicker secretion. **OXYTOCIN** stimulates the uterus to contract during labor and stimulates the breast to start releasing milk when a baby nurses. **ANTIDIURETIC HORMONE** reduces urine output by acting on the collecting ducts of the kidney.

Factors That Stimulate or Inhibit Secretion of Growth Hormone

Stimulate Growth Hormone Secretion	Inhibit Growth Hormone Secretion
DECREASED BLOOD GLUCOSE	INCREASED BLOOD GLUCOSE
DECREASED BLOOD FREE FATTY ACIDS	INCREASED BLOOD FREE FATTY ACIDS
INCREASED BLOOD AMINO ACIDS (ARGININE)	AGING
STARVATION OR FASTING,PROTEIN DEFICIENCY	OBESITY
TRAUMA, STRESS, EXCITEMENT EXERCISE	GROWTH HORMONE INHIBITORY HORMONE (SOMATOSTATIN)
TESTOSTERONE, ESTROGEN	GROWTH HORMONE (EXOGENOUS)
DEEP SLEEP (STAGES II AND IV)	SOMATOMEDINS (INSULIN-LIKE GROWTH FACTORS)
GROWTH HORMONE–RELEASING HORMONE	INCREASED BLOOD GLUCOSE
GHRELIN	INCREASED BLOOD FREE FATTY ACIDS
	AGING





Development of pituitary gland

POSTERIOR PITUITARY GLAND AND ITS RELATION TO THE HYPOTHALAMUS

The *posterior pituitary gland,* also called the *neurohypophysis,* is composed mainly of glial-like cells called *pituicytes.* The pituicytes do not secrete hormones; they act simply as a supporting structure for large numbers of *terminal nerve fibers* and *terminal nerve endings* from nerve tracts that originate in the *supraoptic* and *paraventricular nuclei* of the hypothalamus. *If the pituitary stalk is cut above the pituitary gland but the entire hypothalamus is left intact, the posterior pituitary hormones continue to be secreted normally, after a transient decrease for a few days; they are then secreted by the cut ends of the*

fibers within the hypothalamus and not by the nerve endings in the posterior pituitary. The reason for this is that the hormones are initially synthesized in the cell bodies of the supraoptic and paraventricular nuclei and are then transported in combination with "carrier" proteins called neurophysins down to the nerve endings in the posterior pituitary gland, requiring several days to reach the gland. ADH is formed primarily in the supraoptic nuclei, whereas oxytocin is formed primarily in the paraventricular nuclei. Each of these nuclei can synthesize about one sixth as much of the second hormone as of its primary hormone. When nerve impulses are transmitted downward along the fibers from the supraoptic or paraventricular nuclei, the hormone is immediately released from the
secretory granules in the nerve endings by the usual secretory mechanism of exocytosis and is absorbed into adjacent capillaries. Both the neurophysin and the hormone are secreted together, but because they are only loosely bound to each other, the hormone separates almost immediately. The neurophysin has no known
function after leaving the nerve terminals.