



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

السلام عليكم ورحمة الله وبركاته

Physiology of Hypothalamic- Pituitary Axis

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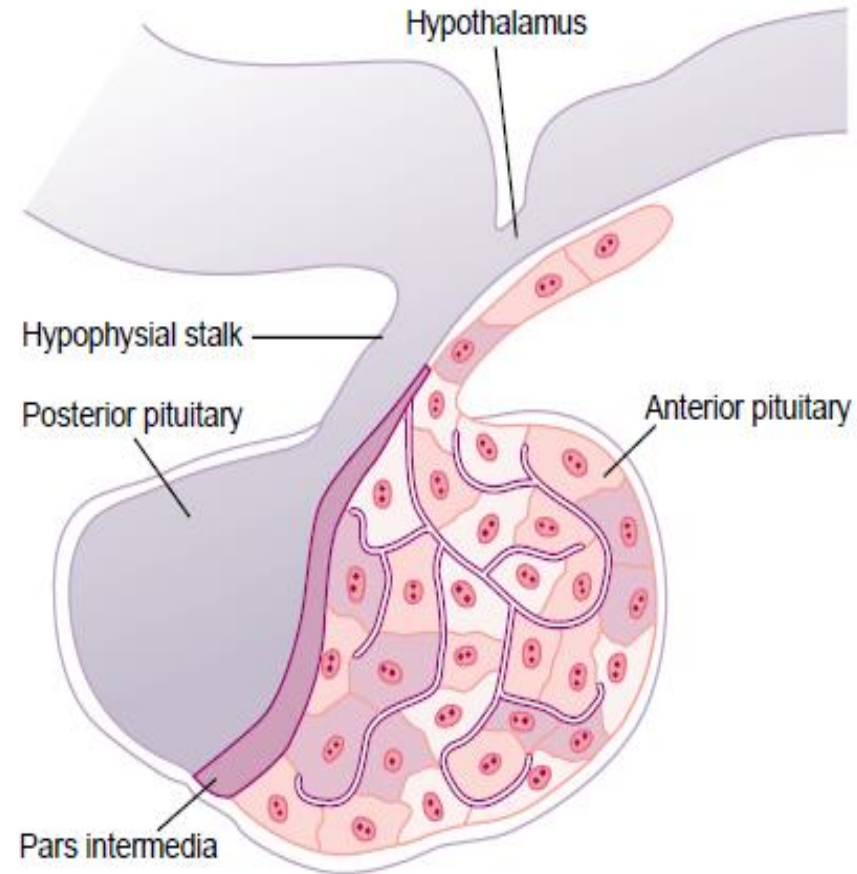
Objectives

- Pituitary gland and its relation to hypothalamus
- Anterior pituitary cell types and hormones
- Posterior pituitary cell types and hormones
- Control of pituitary secretion by hypothalamus
 - Hypothalamo-hypophysial portal system
 - Hypothalamo-hypophysial tract
- Feedback mechanisms
 - Positive feedback
 - Negative feedback

Pituitary gland and its relation to hypothalamus

- The pituitary gland (the hypophysis), is a small gland about 1 cm in diameter and 0.5 to 1 g in weight
- It lies in the sella turcica, a bony cavity at the base of the skull
- It is connected to the hypothalamus by the pituitary (or hypophysial) stalk.

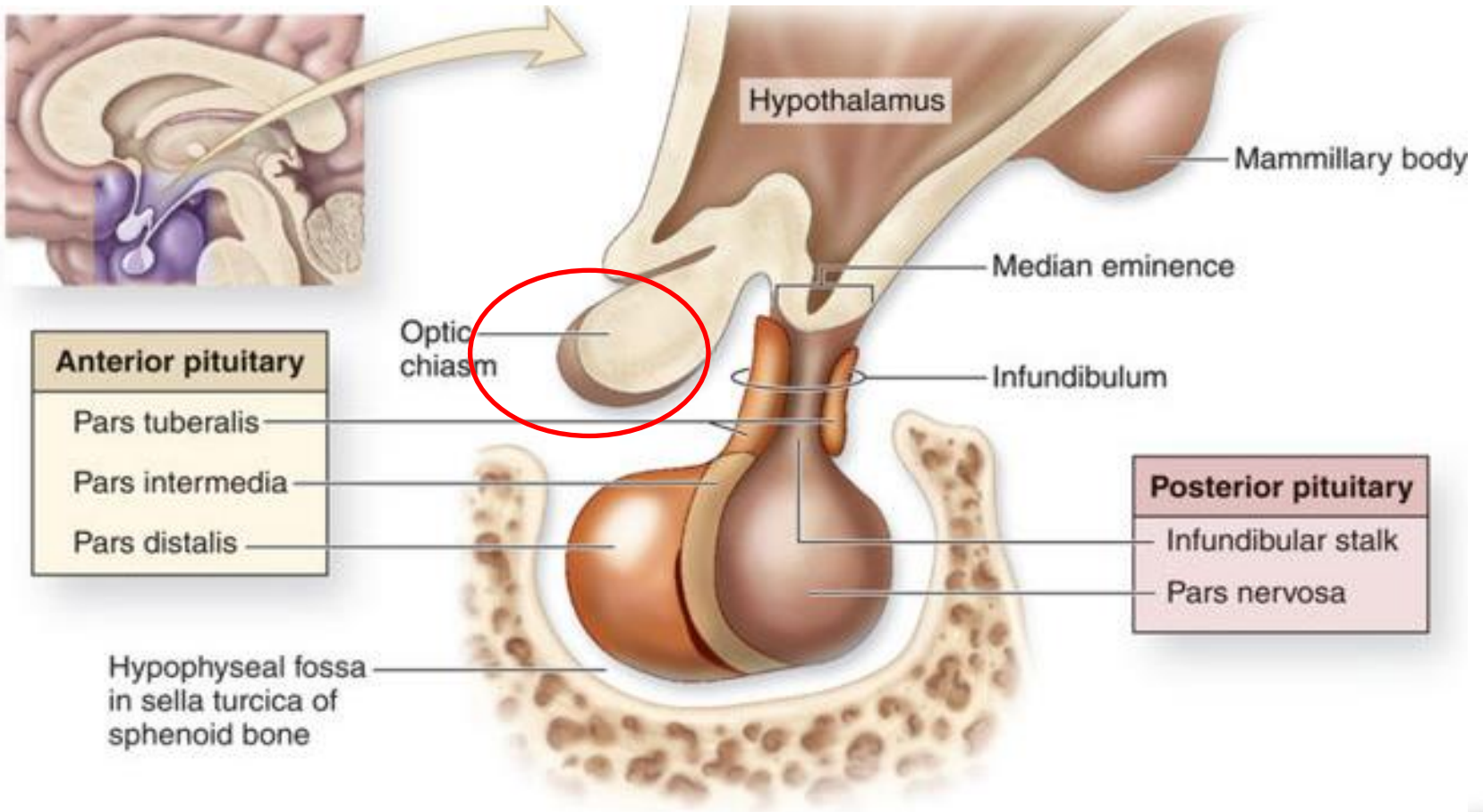
- Physiologically, the pituitary gland is divisible into two distinct portions (lobes):
- Anterior (Adenohypophysis)
- Posterior (Neurohypophysis)
- Between these is a small, the pars intermedia, which is almost absent in the human being but is much larger and functional in some lower animals.



Embryonic origin of pituitary gland

- Anterior pituitary originates from Rathke's pouch (invagination of the pharyngeal epithelium). This explains the epithelioid nature of its cells.
- Posterior pituitary originates from neural tissue outgrowth from hypothalamus. This explains the presence of large numbers of glial-type cells in this gland

Structure of pituitary gland (Relation to optic chiasm)



Control of pituitary secretion by hypothalamus

Almost all secretions by the pituitary is controlled by signals from the hypothalamus:

- 1- Hormonal signals (control anterior pituitary secretion)
- 2- Nervous signals (control posterior pituitary secretion)

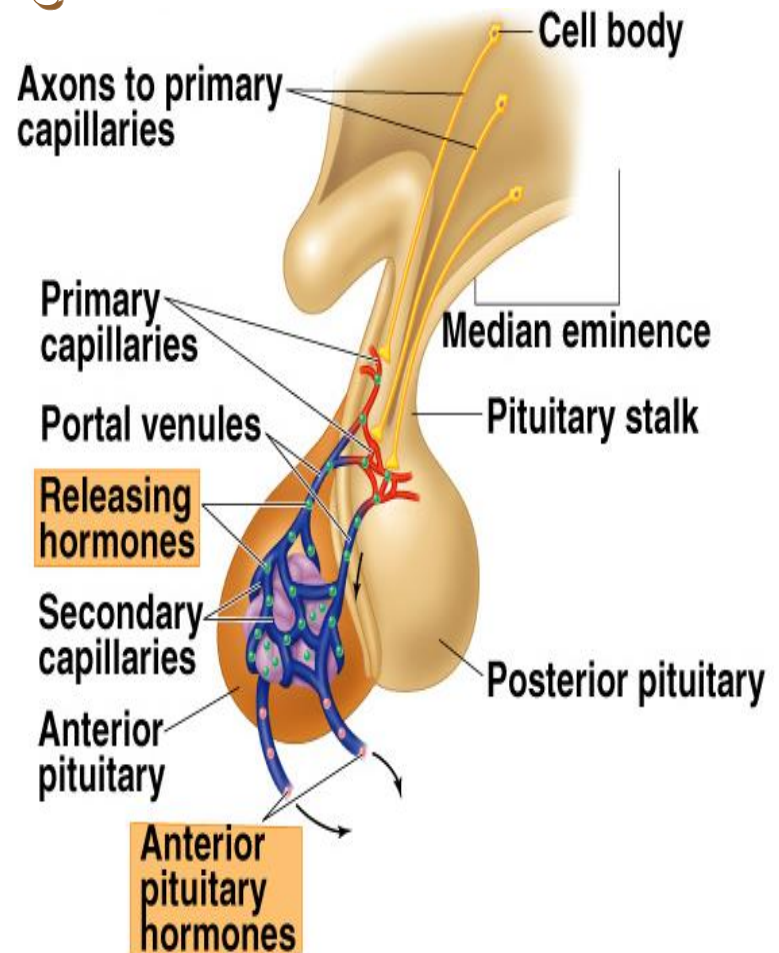
Hypothalamic control of anterior pituitary

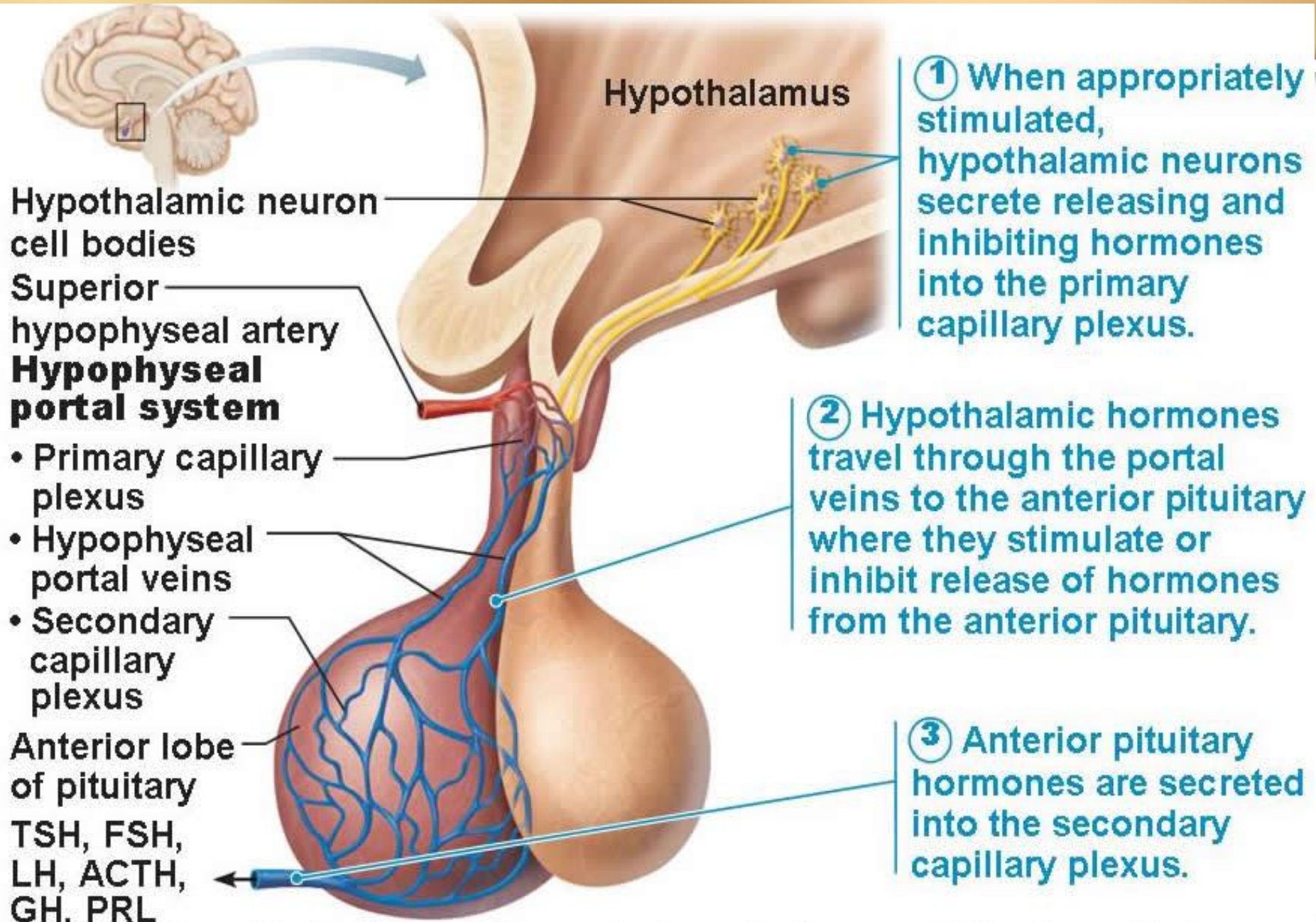
- Secretion by the anterior pituitary is controlled by special neurons in the hypothalamus that synthesize and secrete releasing and hypothalamic inhibitory hormones (or factors)
- Neurons send their nerve fibers to the median eminence (the lowermost portion of the hypothalamus, which connects inferiorly with the pituitary stalk) and tuber cinereum, an extension of hypothalamic tissue into the pituitary stalk.
-

Hypothalamic

control of anterior pituitary (Cont.)

- The function of endings of these hypothalamic fibers is 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.



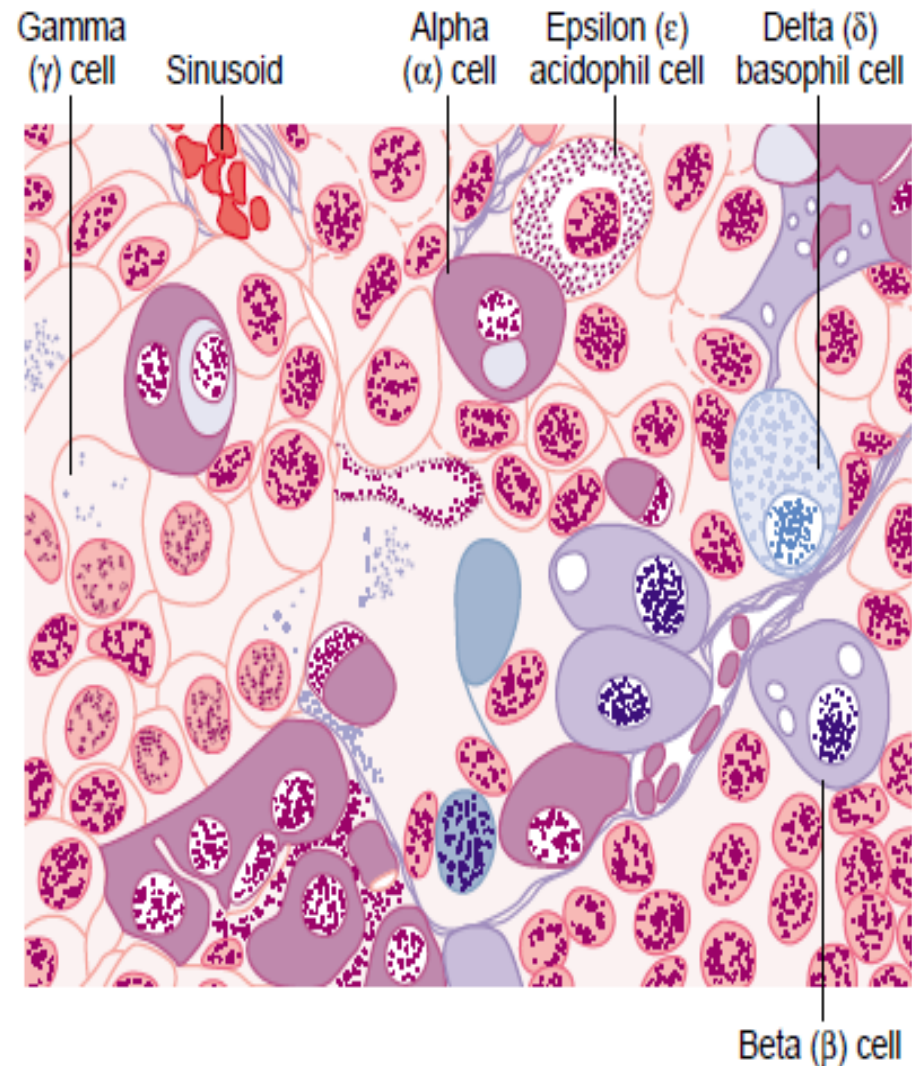


(b) Relationship between the anterior pituitary and the hypothalamus

Hormones of anterior pituitary and its cellular structure

Anterior pituitary secretes the following hormones:

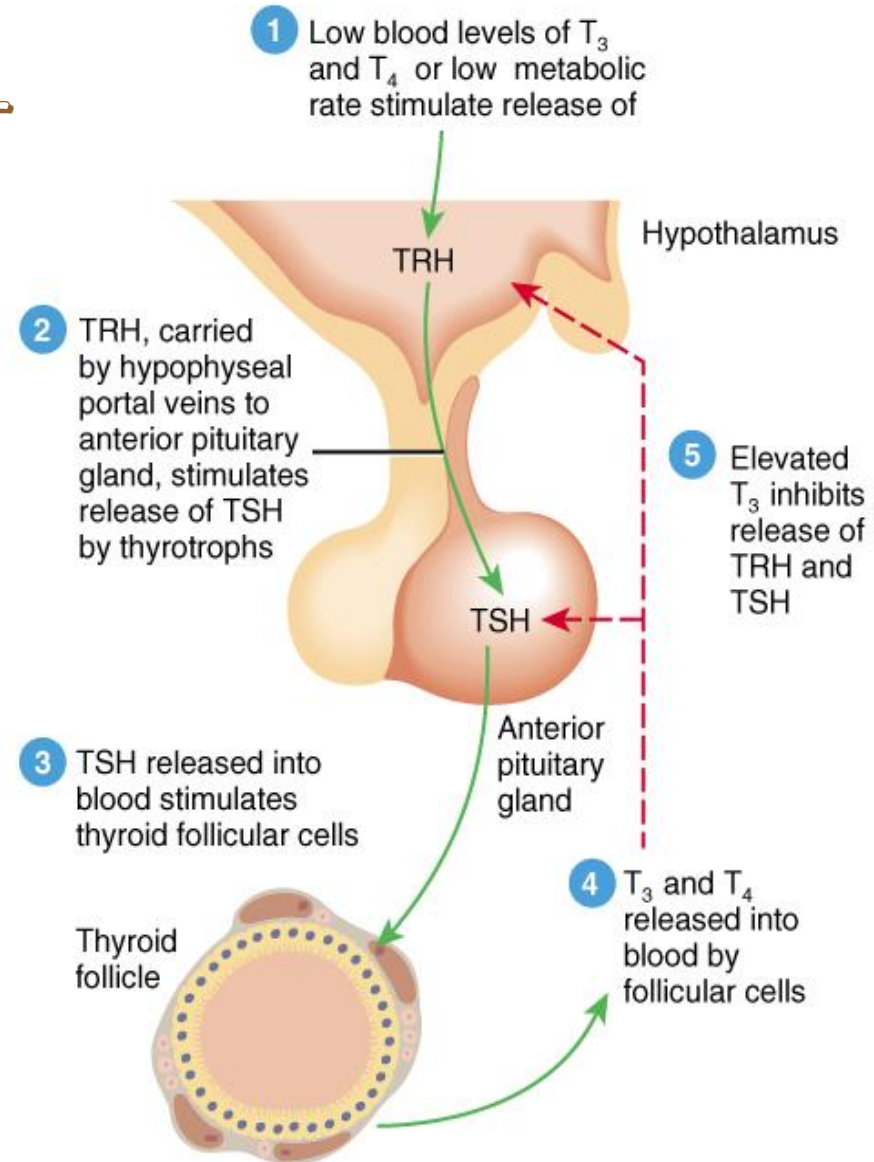
- GH (somatotropin): From somatotrops
- ACTH (Corticotropin): From corticotrops
- TSH(Thyrotropin): From thyrotropes
- LH & FSH: From gonadotropes
- Prolactin (PRL): Lactotrops



Hypothalamic releasing & inhibiting hormones

Thyrotropin-releasing hormone (TRH)

- Stimulates release of thyroid stimulating hormone (TSH)

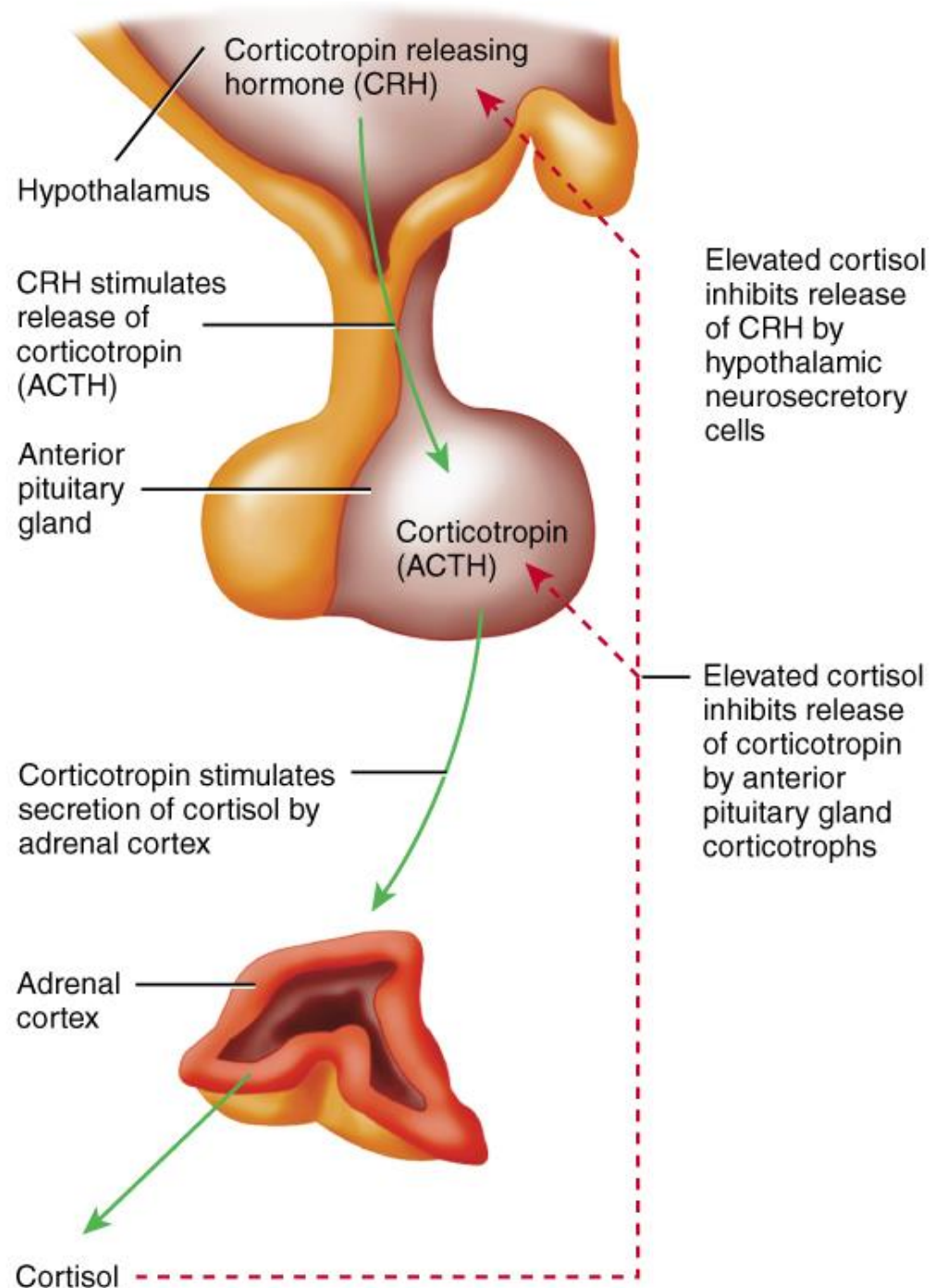


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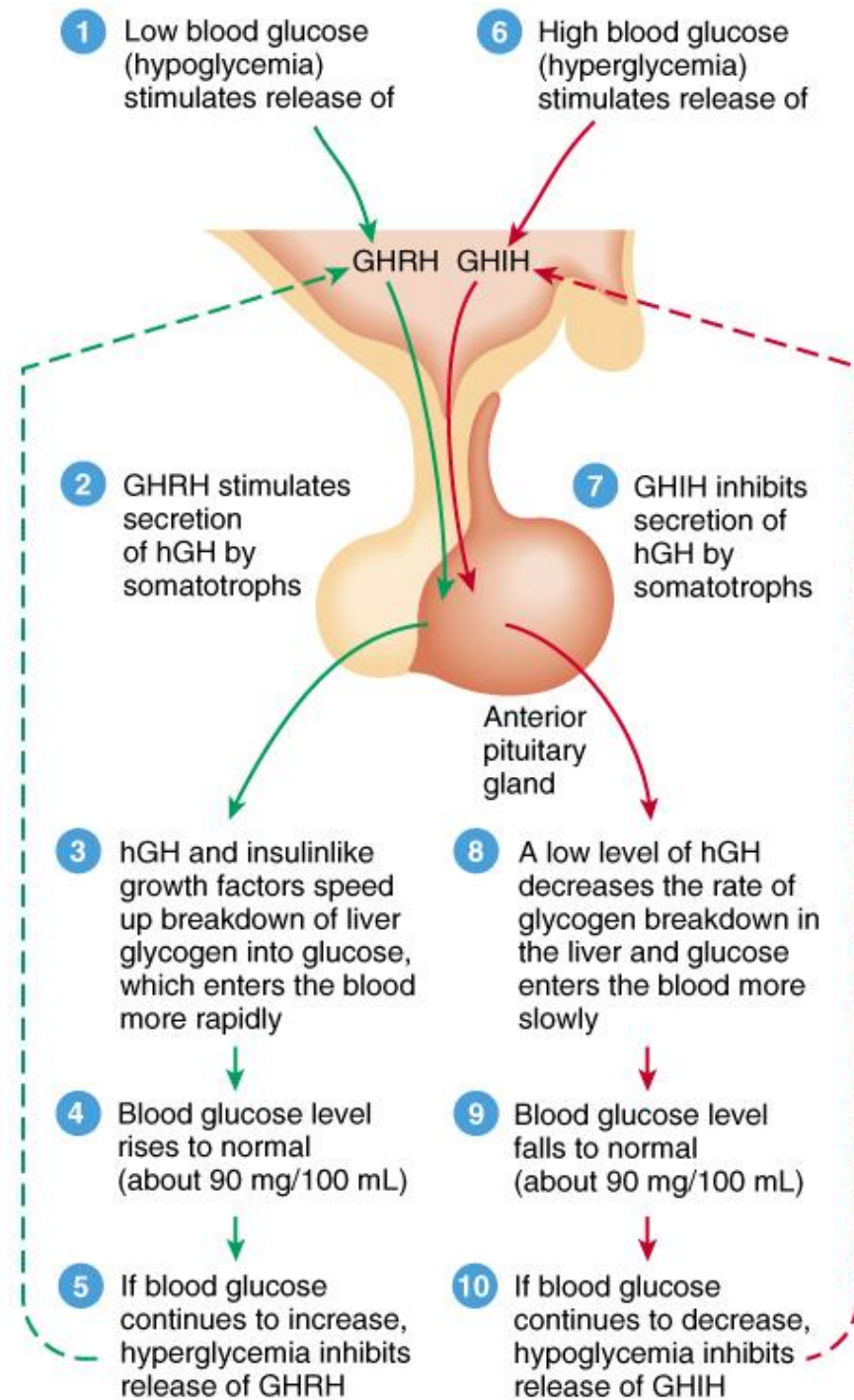
TRH = Thyrotropin releasing hormone
TSH = Thyroid-stimulating hormone
 T_3 = Triiodothyronine
 T_4 = Thyroxine (Tetraiodothyronine)

Corticotropin-releasing hormone (CRH)

- Stimulates release of adrenocorticotropin hormone (ACTH)



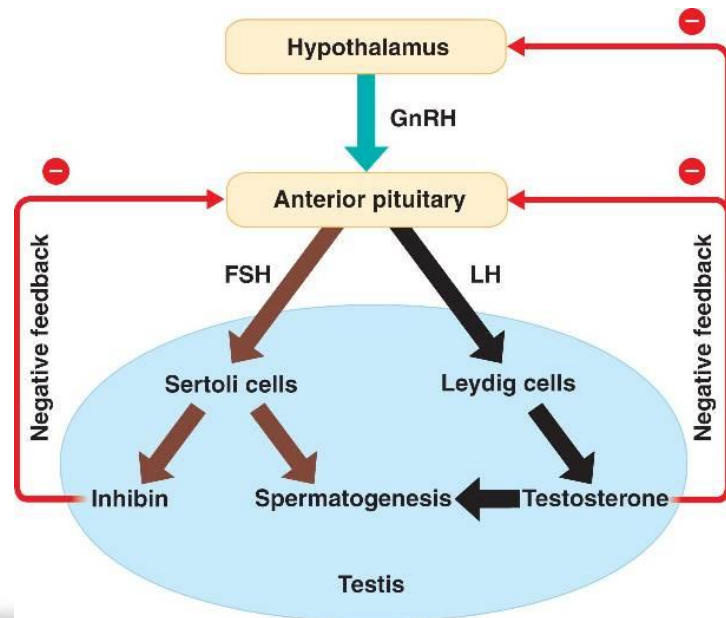
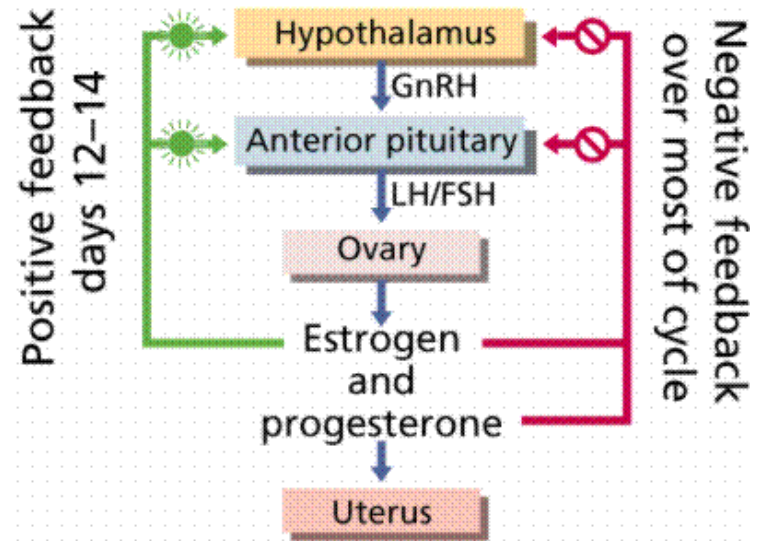
- **Growth hormone releasing hormone (GHRH)**
 - Stimulates release of growth hormone
- **Growth hormone inhibiting hormone (GHIH) also called Somatostatin**
 - Inhibits release of growth hormone



- **Gonadotropin releasing hormone (GnRH)**

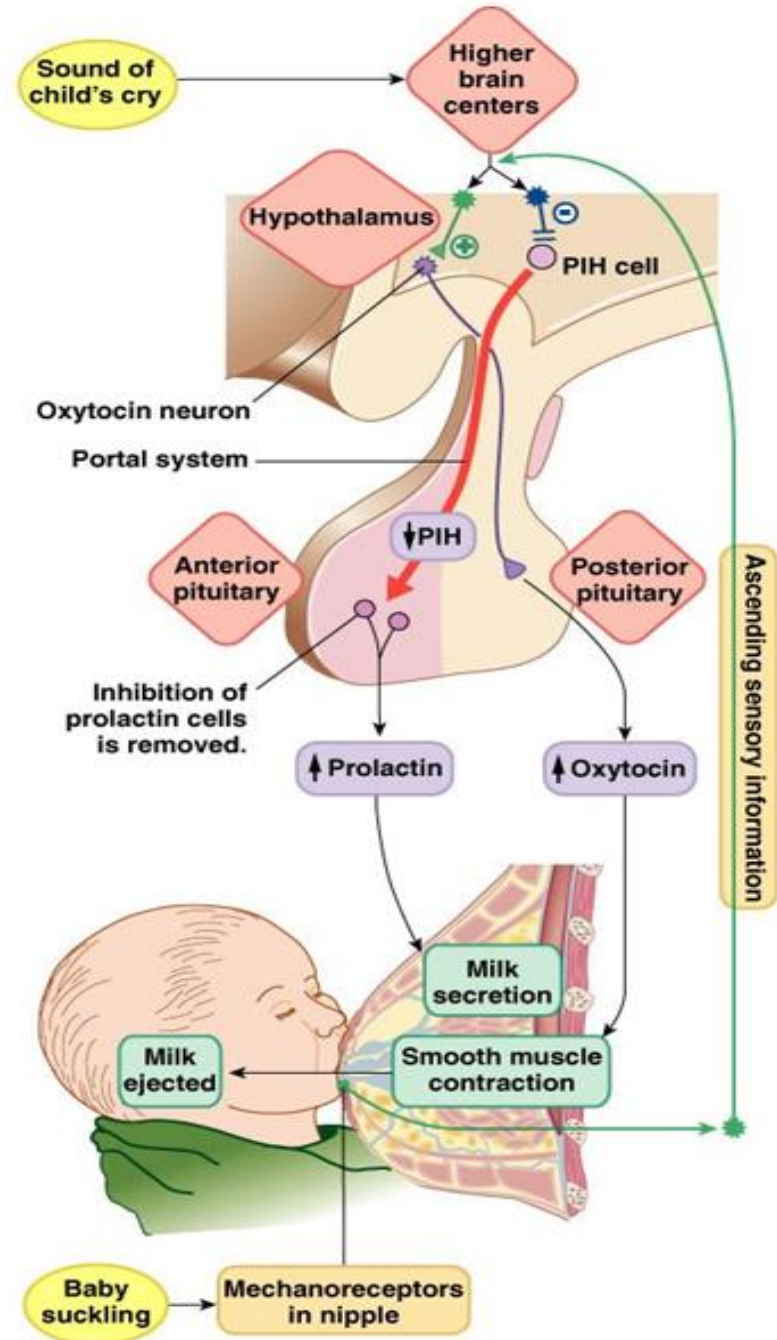
causes release of the 2 gonadotropic hormones:

- Luteinizing (**LH**)
- Follicle-stimulating hormone **FSH**



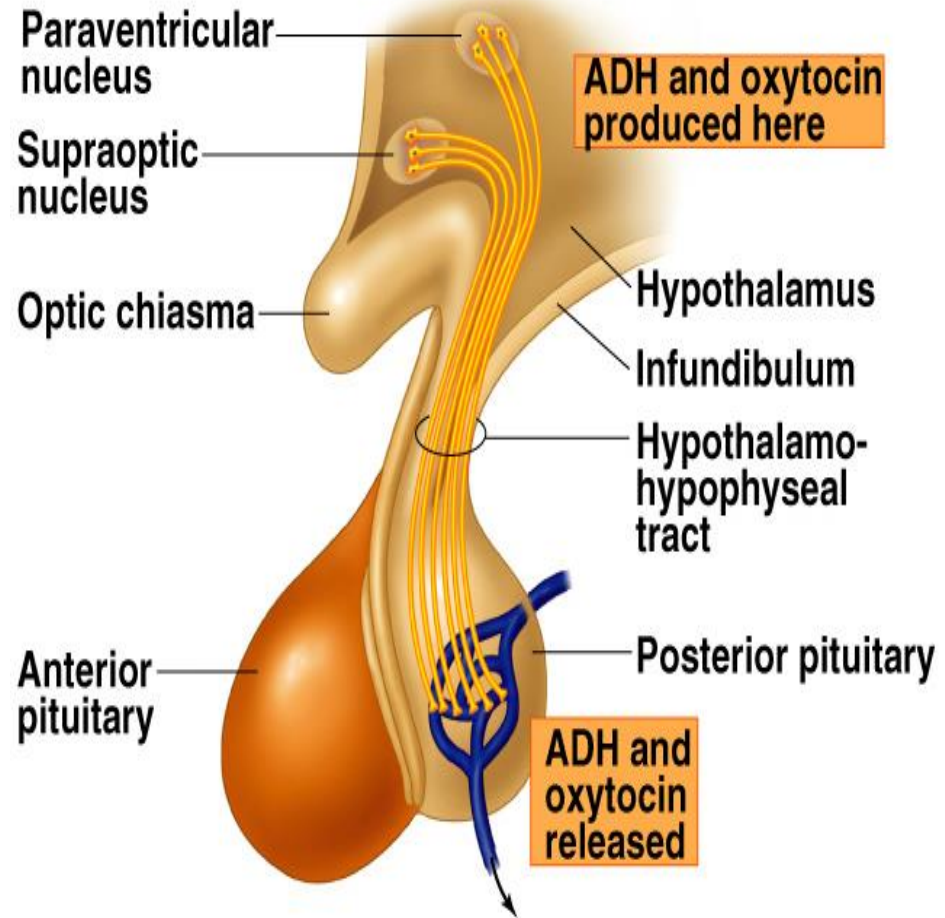
Prolactin inhibitory hormone (PIH) also known as Dopamine

- Inhibits prolactin secretion

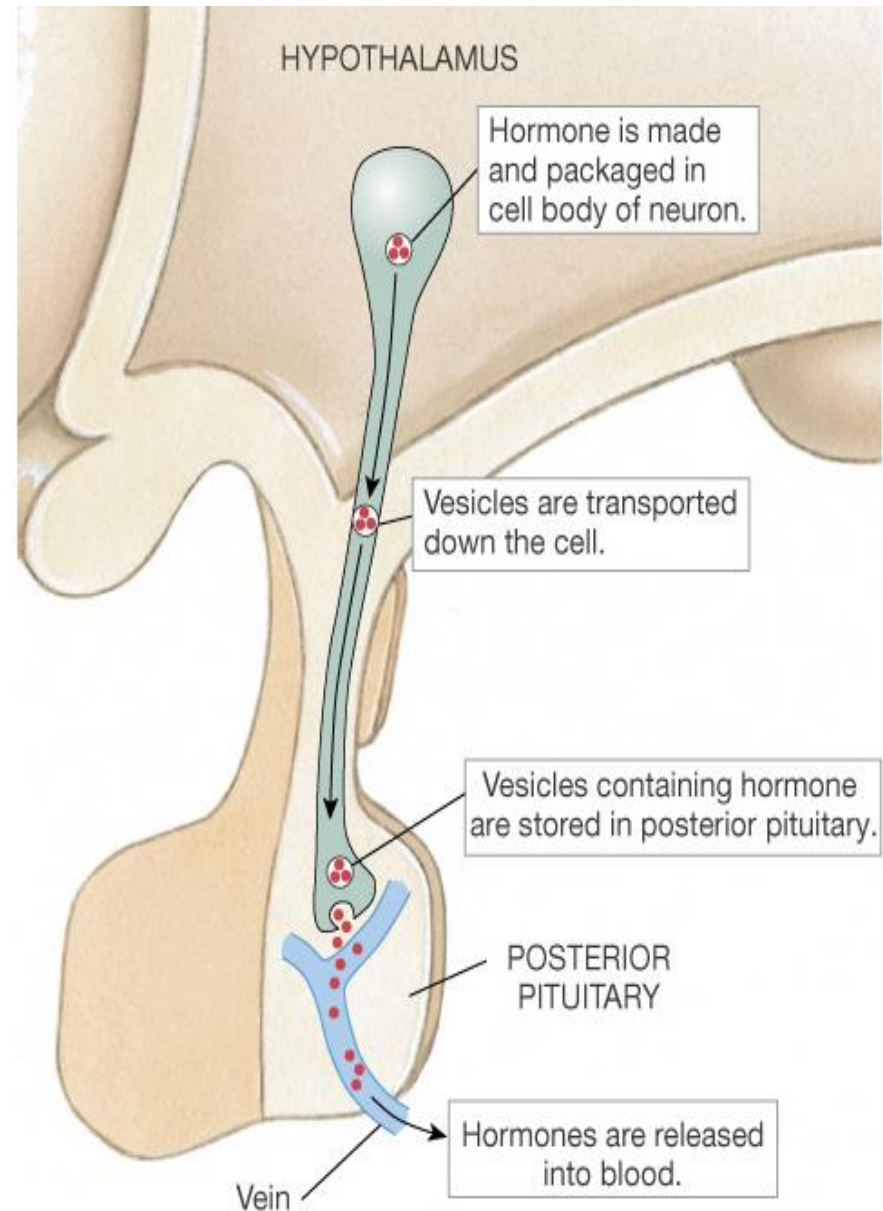


Hypothalamic control of posterior pituitary gland

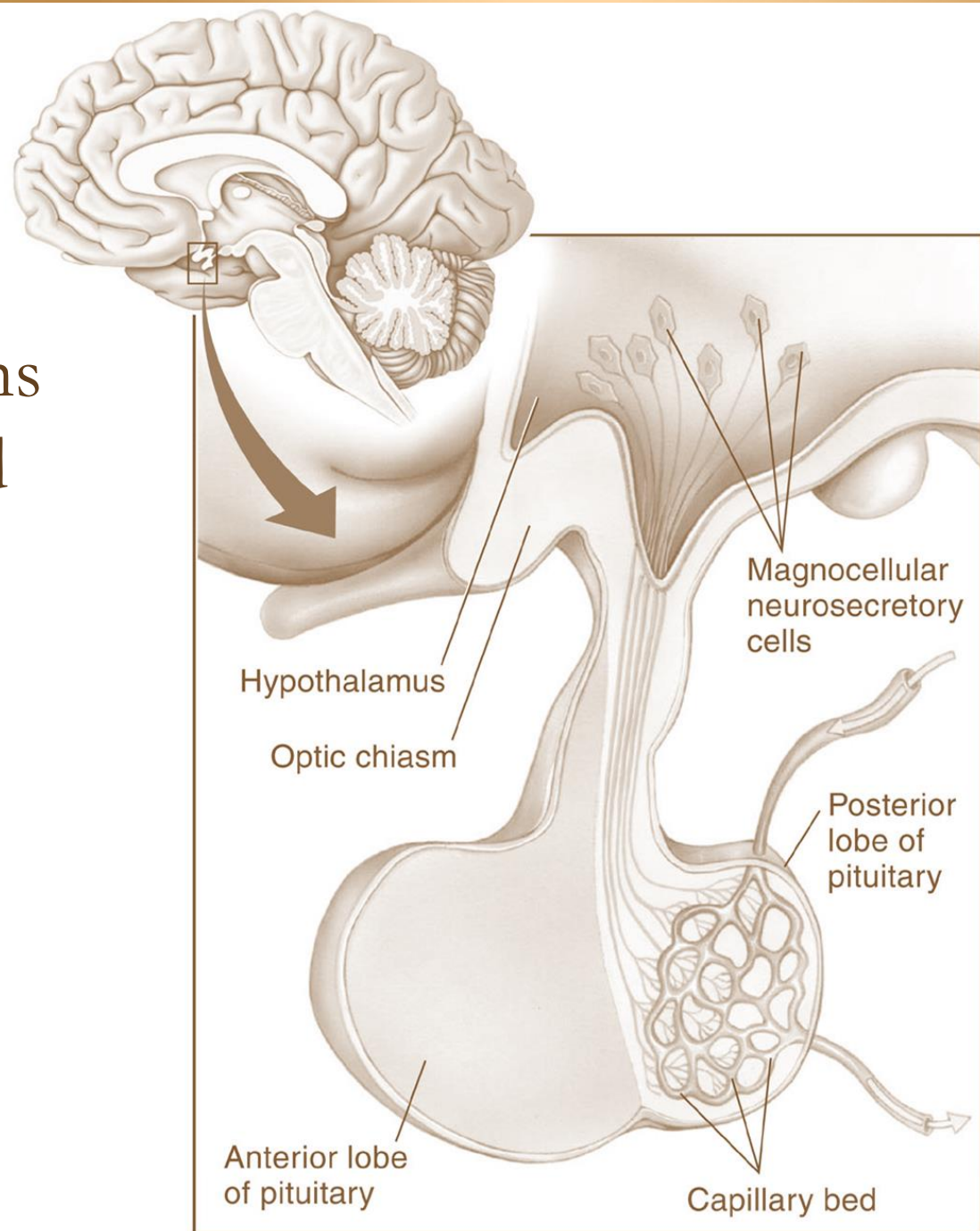
- The posterior pituitary gland is composed mainly of glial-like cells called pituicytes.
- The pituicytes do not secrete hormones; they act as a supporting structure for terminal nerve fibers and endings from nerve tracts that originate in the supraoptic and paraventricular nuclei of the hypothalamus.



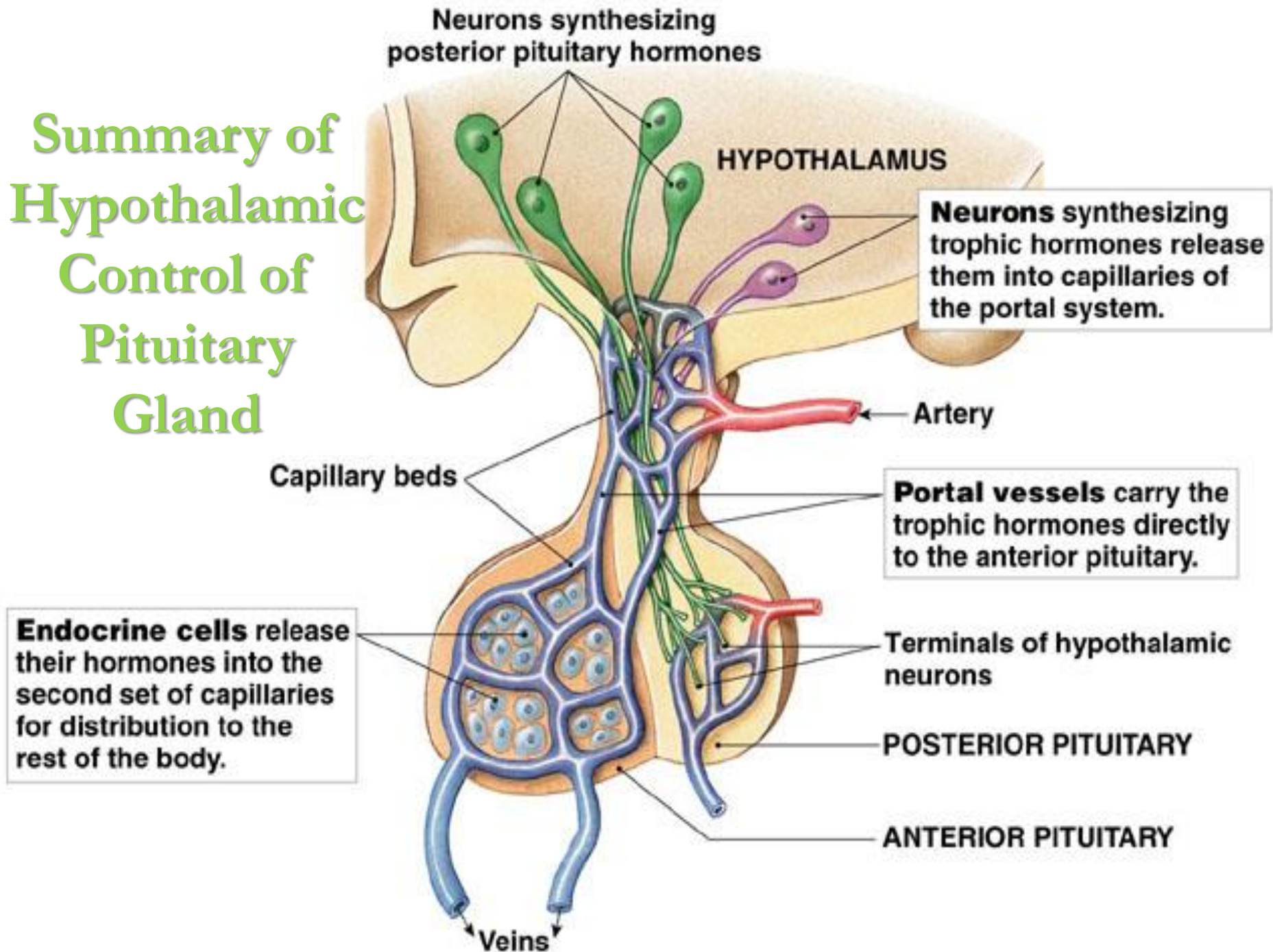
- ◎ These tracts pass to the neurohypophysis through the pituitary stalk.
- ◎ The nerve endings lie on the surfaces of capillaries, where they secrete two posterior pituitary hormones:
 1. Antidiuretic hormone (ADH), vasopressin
 2. Oxytocin

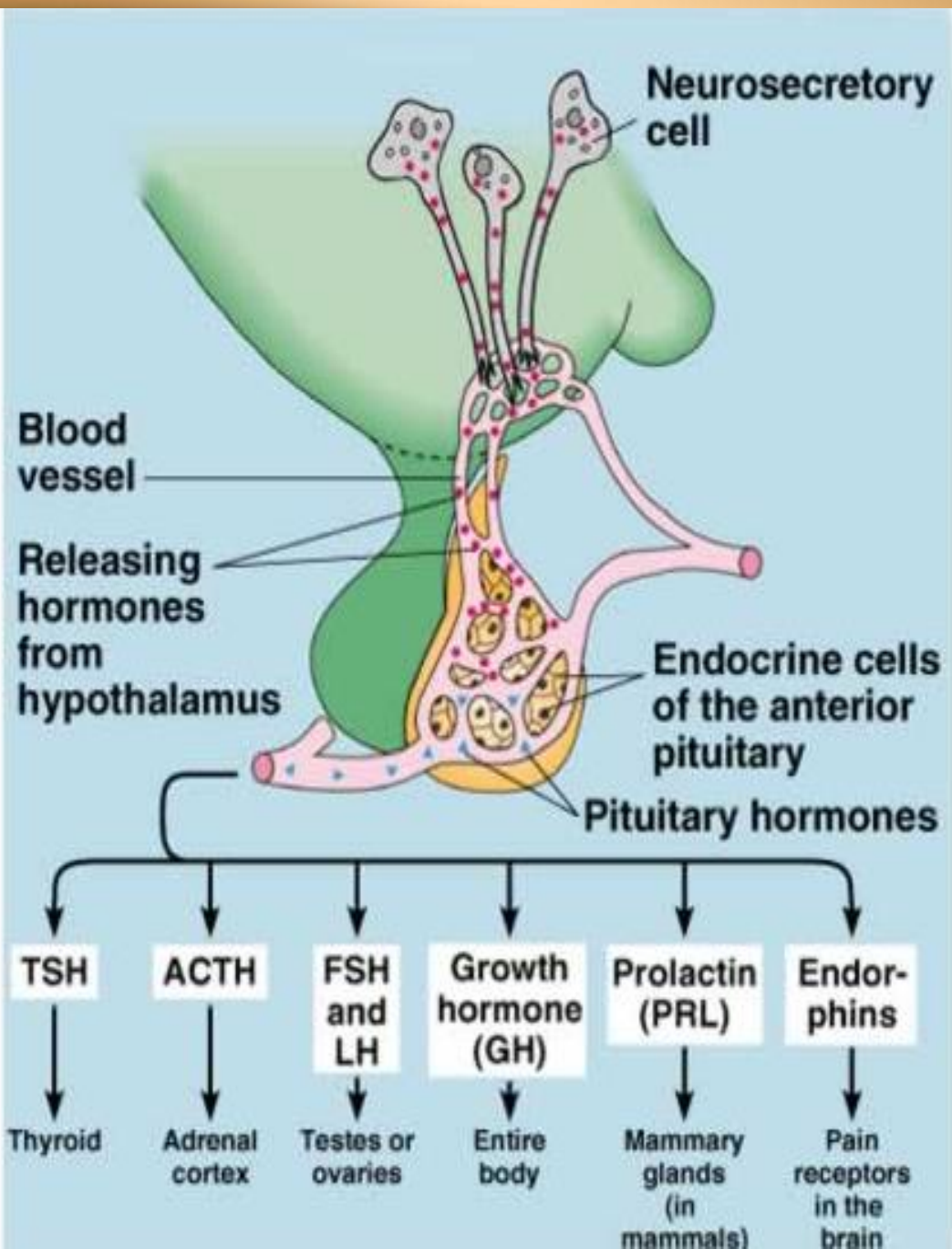
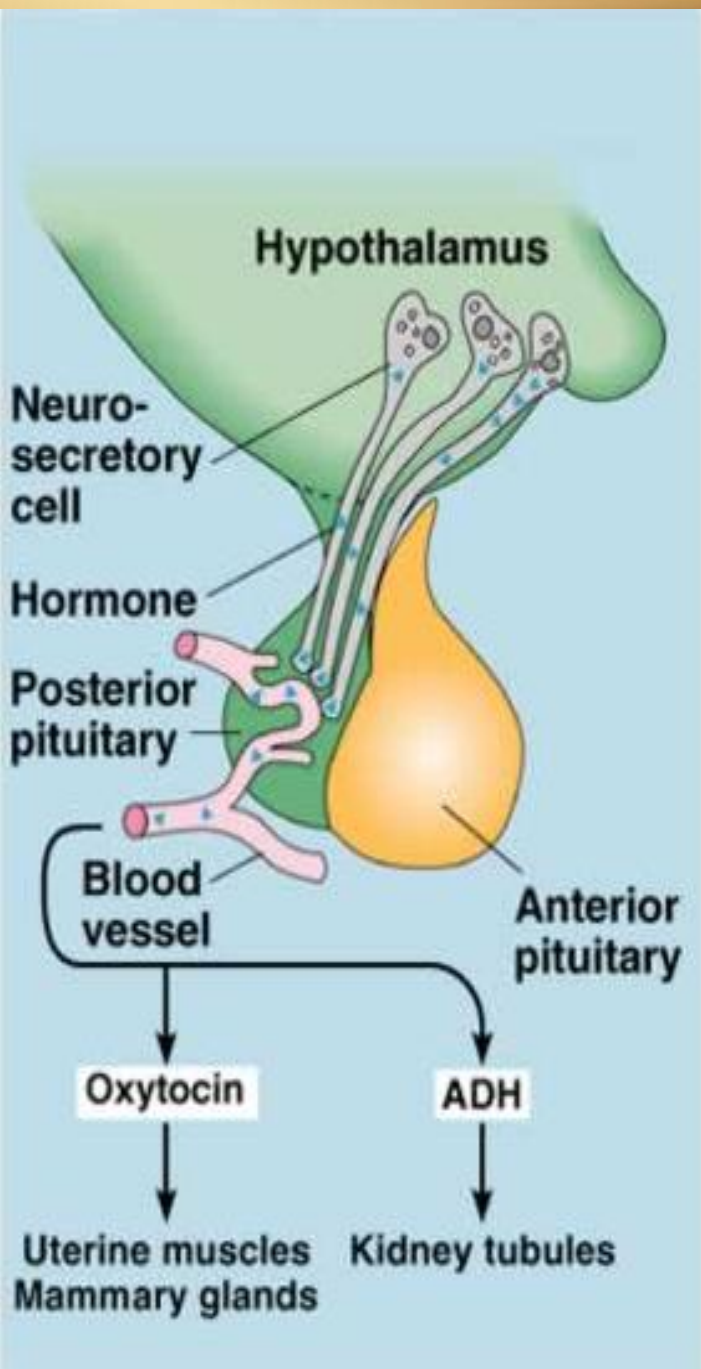


Magnocellular neurons in paraventricular and supraoptic nuclei secrete **oxytocin** and **vasopressin** directly into capillaries in the posterior lobe



Summary of Hypothalamic Control of Pituitary Gland



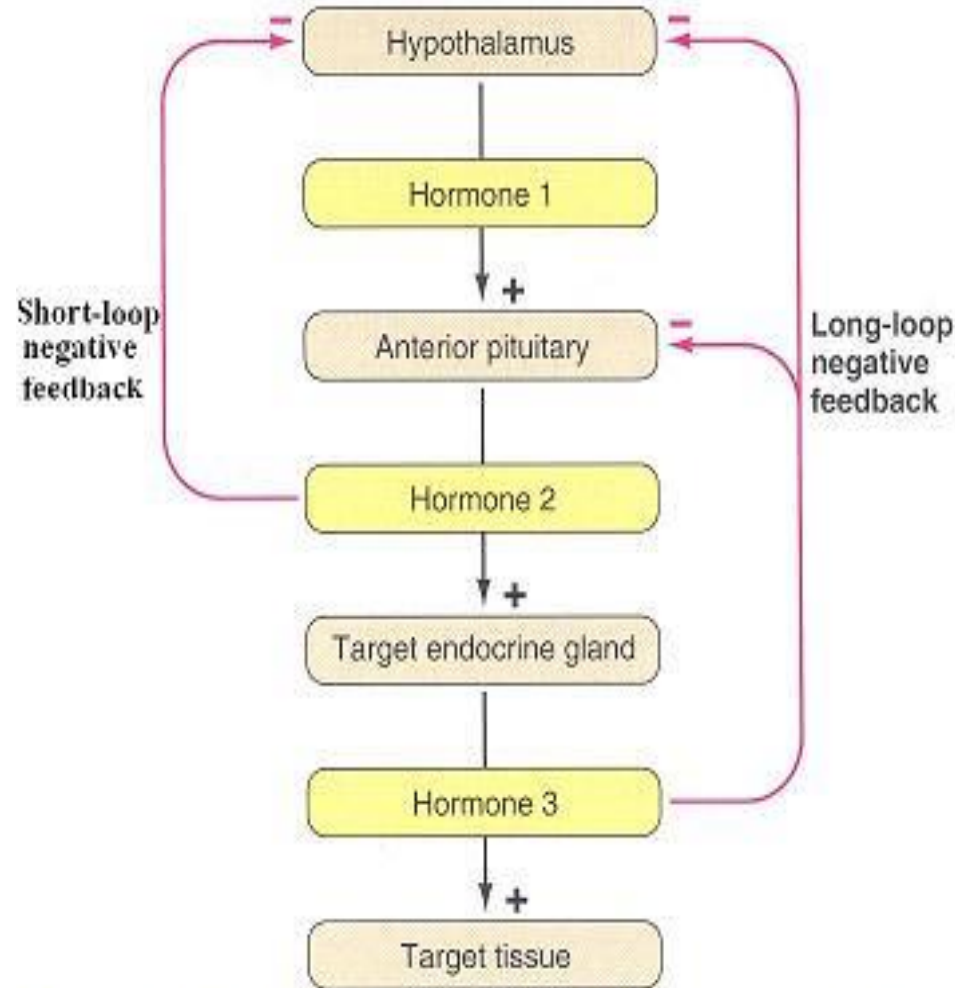


Feedback control of hormone secretion

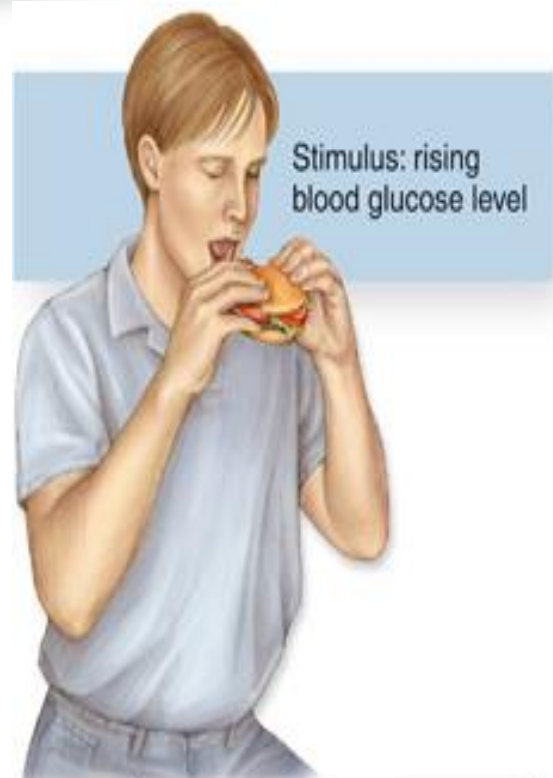
1- Negative feedback

After a stimulus causes release of the hormone, conditions or products resulting from its action tend to suppress its further release to prevent oversecretion of the hormone.

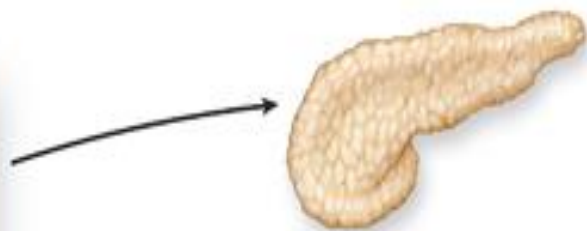
This is controlled by the degree of activity of the target tissue.



Negative feedback in hypothalamic-anterior pituitary control systems



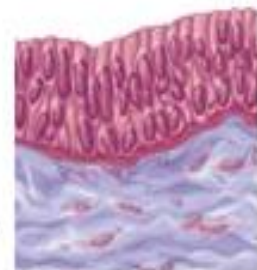
Stimulus: rising blood glucose level



High blood glucose level is detected by insulin-secreting cells of pancreas.



Pancreas secretes the hormone insulin causing liver cells to take up glucose and store it as glycogen.



Most body cells also take up more glucose.

Return to homeostatic blood glucose level

As body cells take up blood glucose, glucose levels in the blood decline, and insulin release stops (negative feedback).

(a) Negative feedback

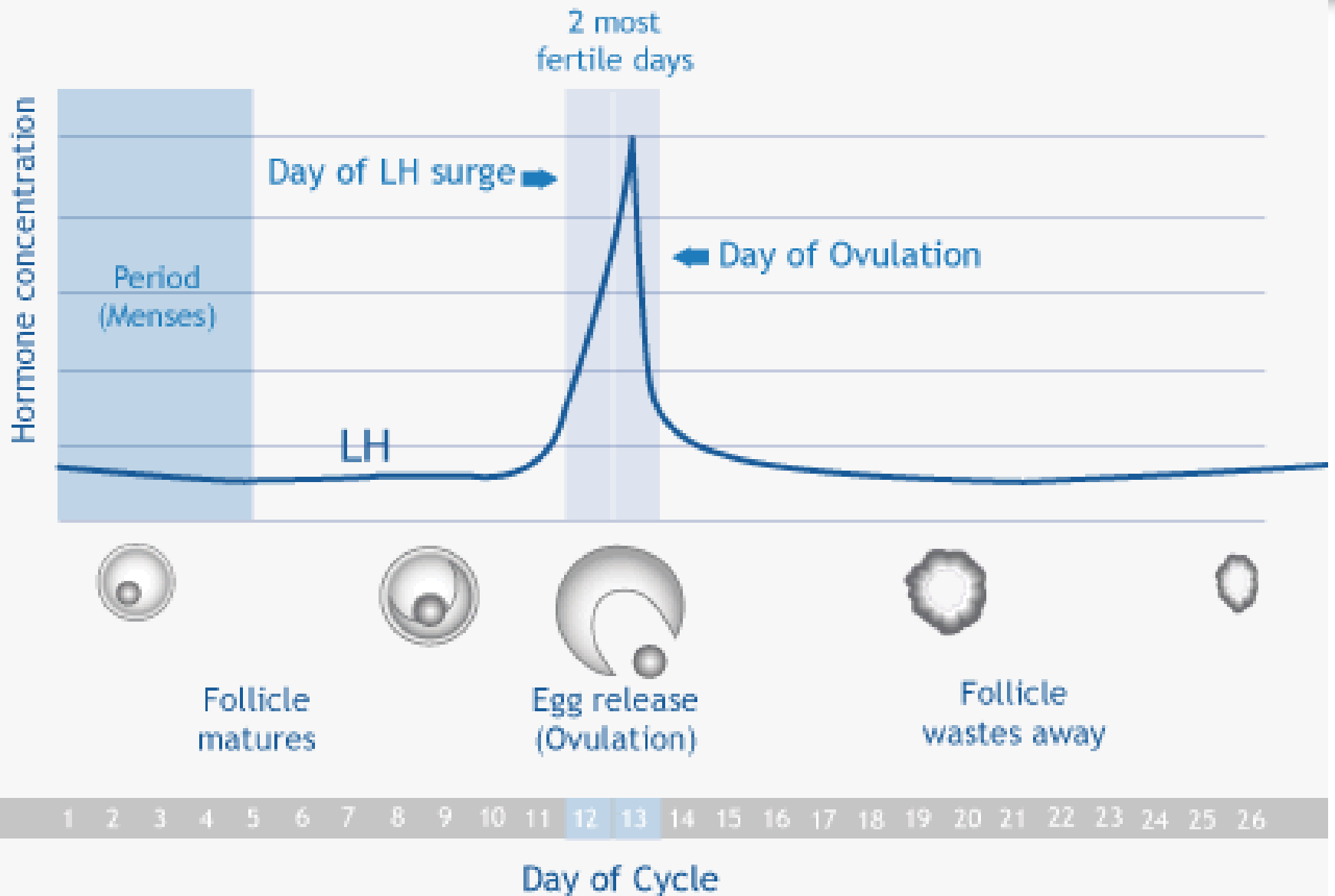
2- Positive feedback

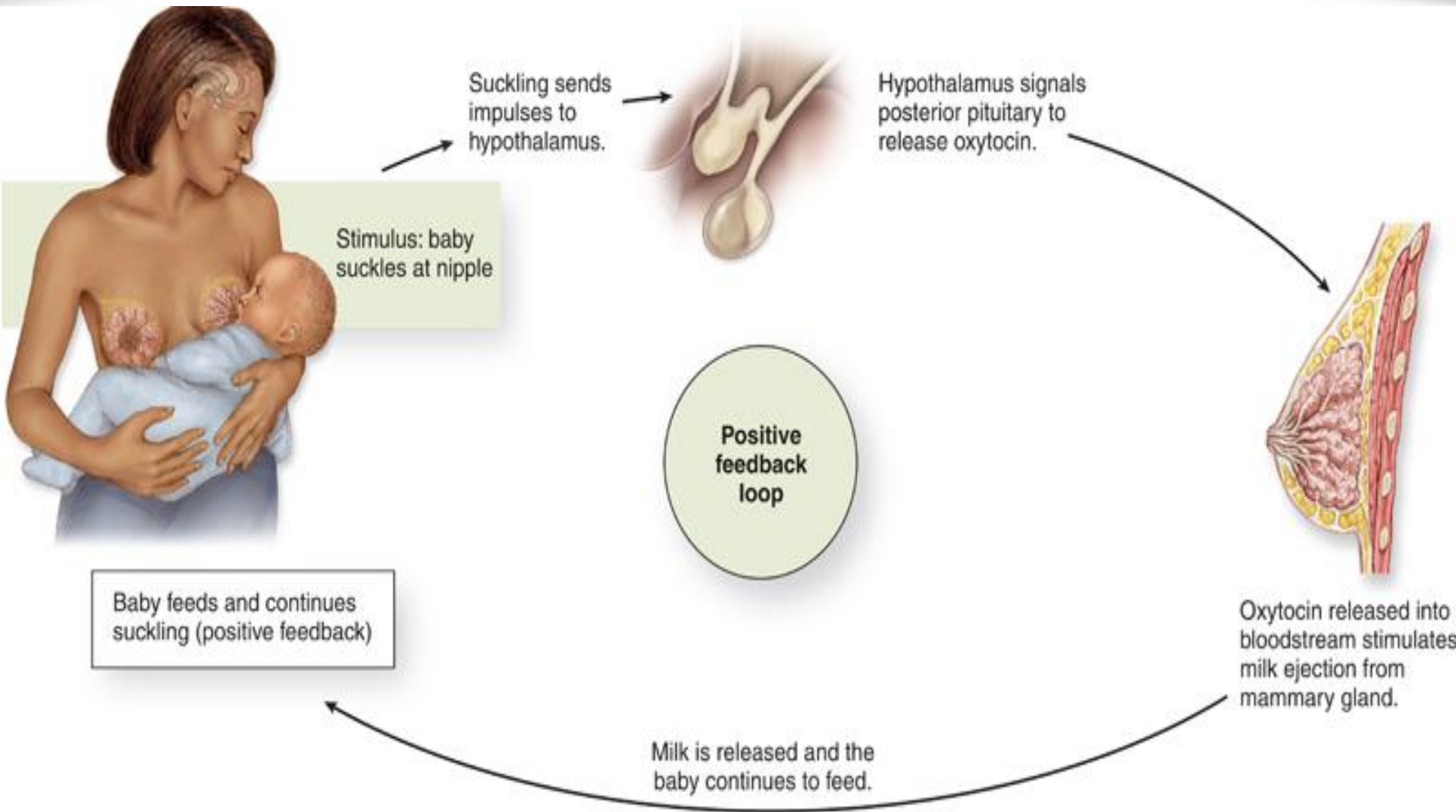
It occurs when the biological action of the hormone causes additional secretion of the hormone.

Example:

The LH surge occurs as a result of the stimulatory effect of E2 on the anterior pituitary before ovulation. The secreted LH then acts on the ovaries to stimulate secretion of E2, which in turn causes more secretion of LH.

Eventually, LH reaches an appropriate concentration, and typical negative feedback control of hormone secretion is then exerted.





(b) Positive feedback

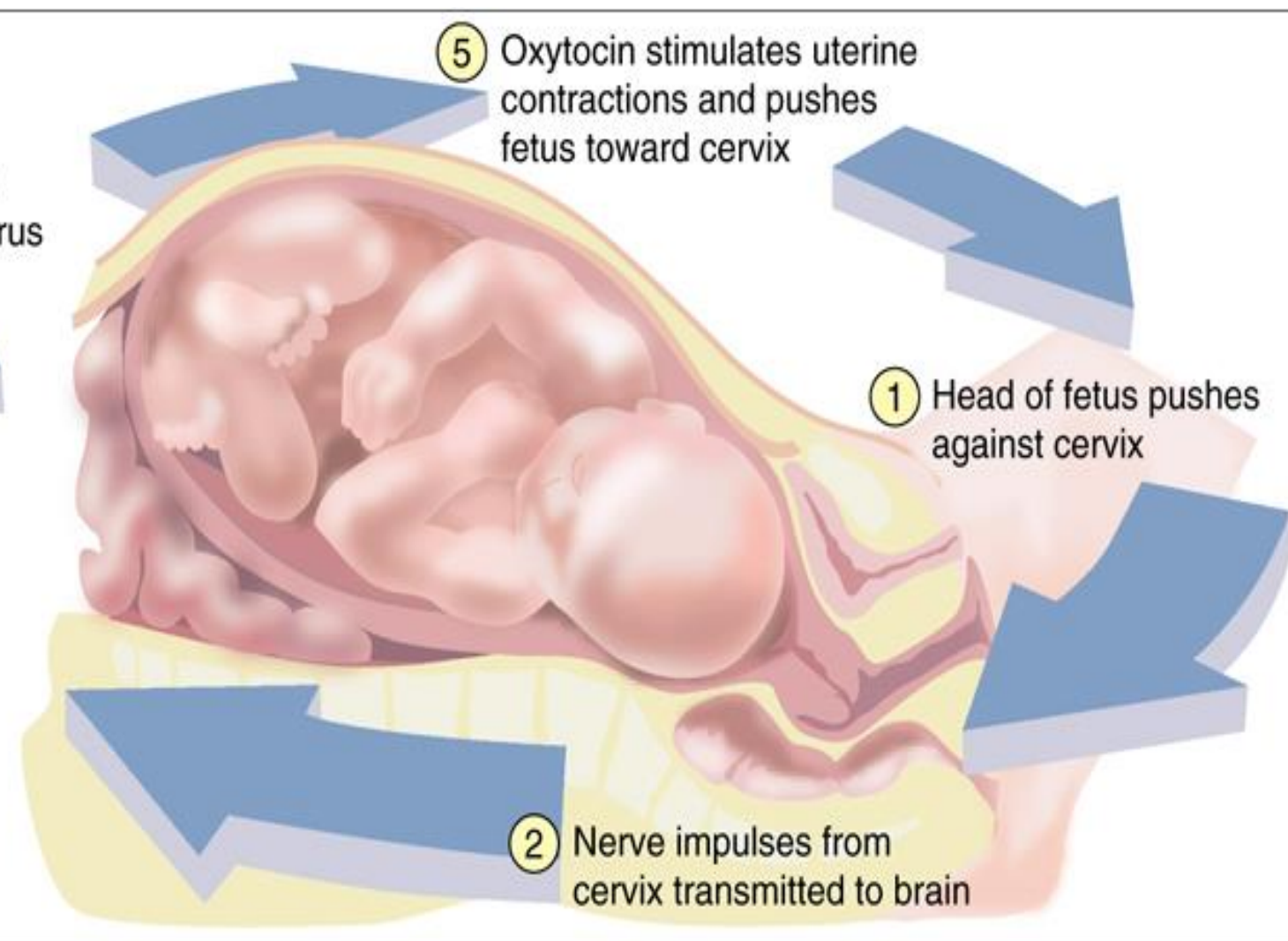
4 Oxytocin carried in bloodstream to uterus

3 Brain stimulates pituitary gland to secrete oxytocin

5 Oxytocin stimulates uterine contractions and pushes fetus toward cervix

1 Head of fetus pushes against cervix

2 Nerve impulses from cervix transmitted to brain



Thank You

The text "Thank You" is written in a large, elegant, cursive script. The letters are filled with a deep red color and have a thin, metallic gold outline. The text is set against a white background with a subtle drop shadow. The word "Thank" is on the left and "You" is on the right. The letters are intertwined with decorative elements: red ribbons, clusters of red roses, and two white doves in flight. One dove is positioned above the 'T' in "Thank", and the other is above the 'Y' in "You".