

# **HYPOTHALAMIC-PITUITARY AXIS**

# OBJECTIVES

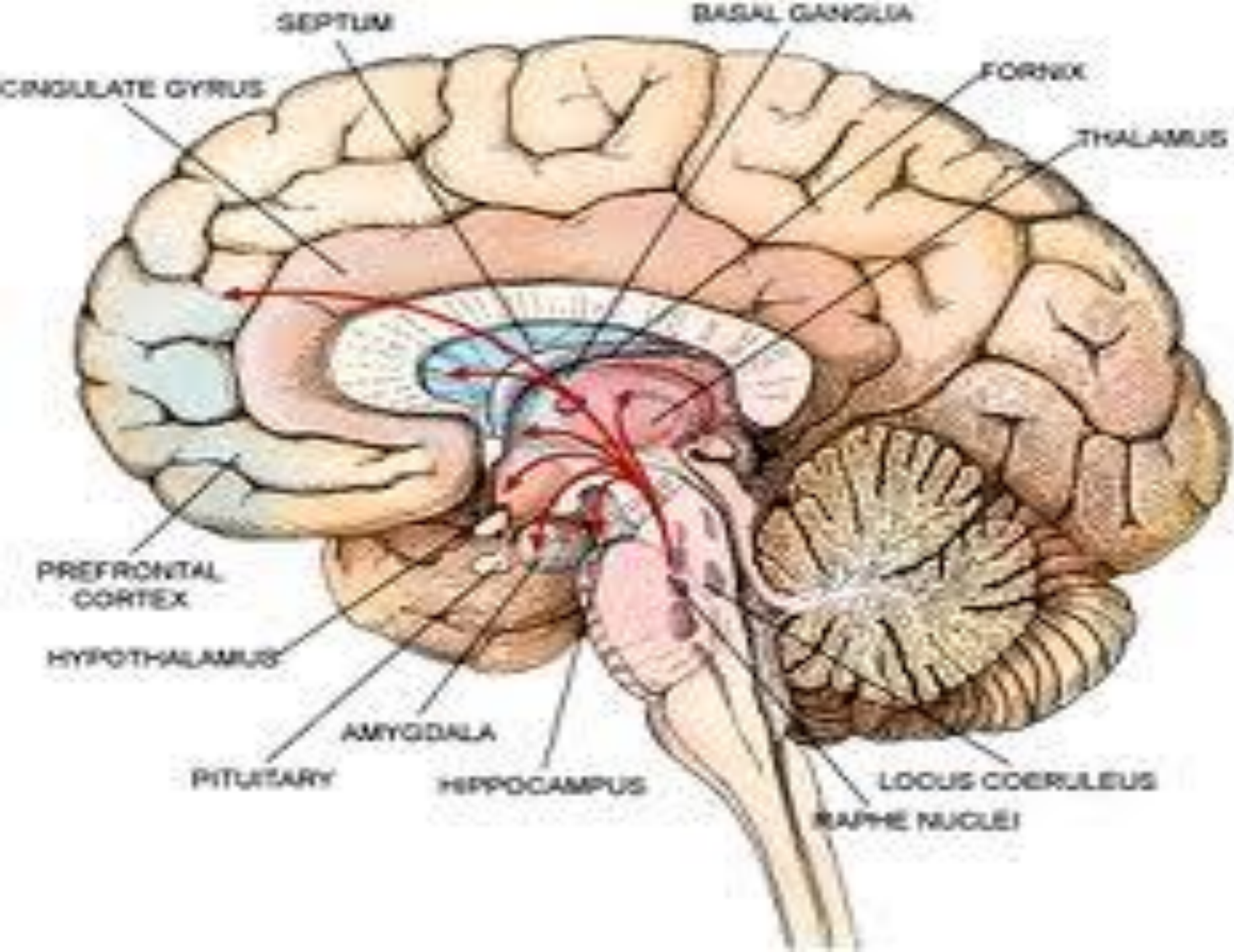
- **By the end of this lecture, students should be able to describe:**
- **Structure of pituitary gland (hypophysis)**
  - Anterior pituitary (adenohypophysis) cell types and hormones
  - Posterior pituitary (neurohypophysis) cell types and hormones
- **Control of pituitary gland by hypothalamus**
  - Hypothalamo-hypophysial portal blood vessels (Hypothalamic releasing and inhibiting hormones and median eminence)
  - Hypothalamo-hypophysial tract
- **Feedback mechanisms: positive and negative feedback**

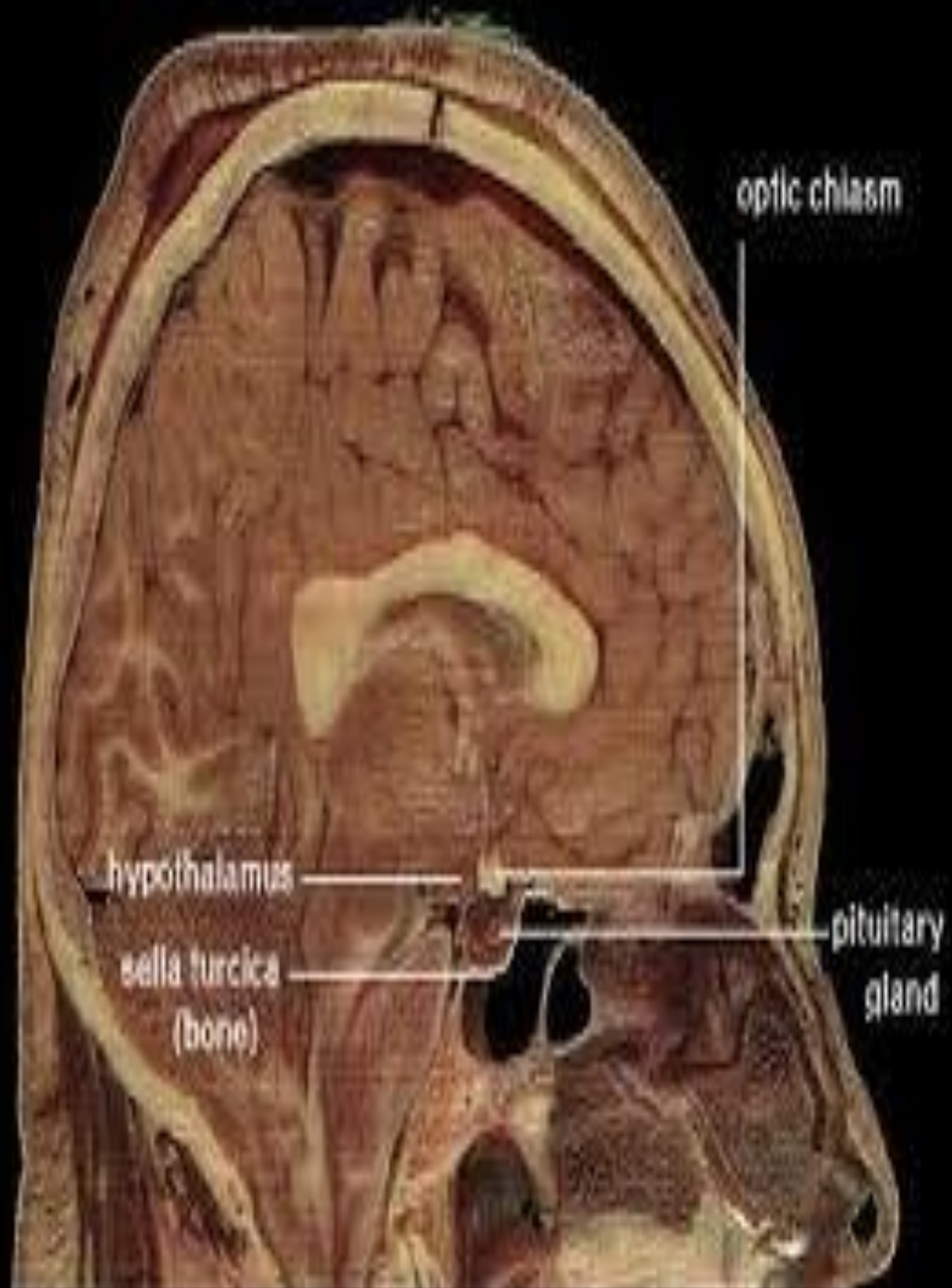
# **HYPOTHALAMIC-PITUITARY AXIS**

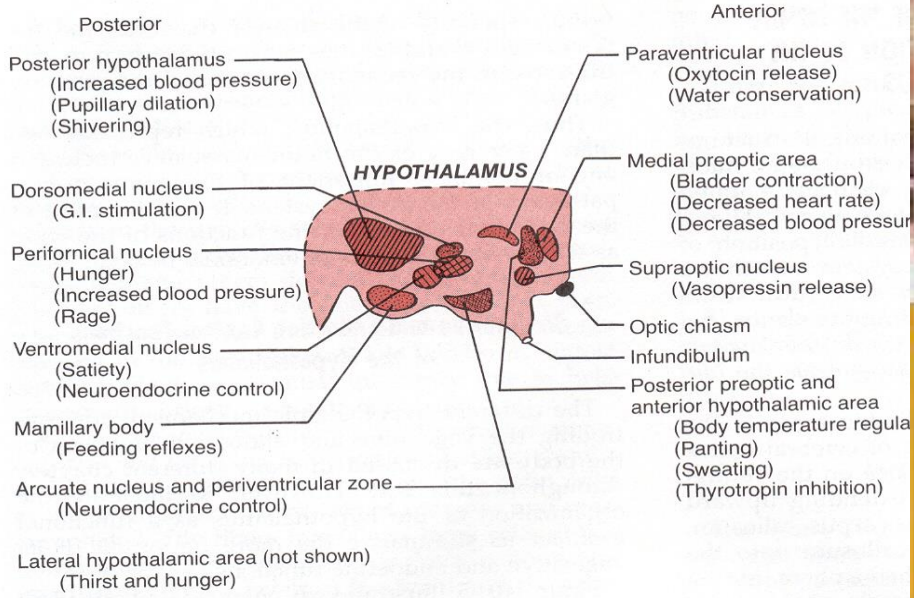
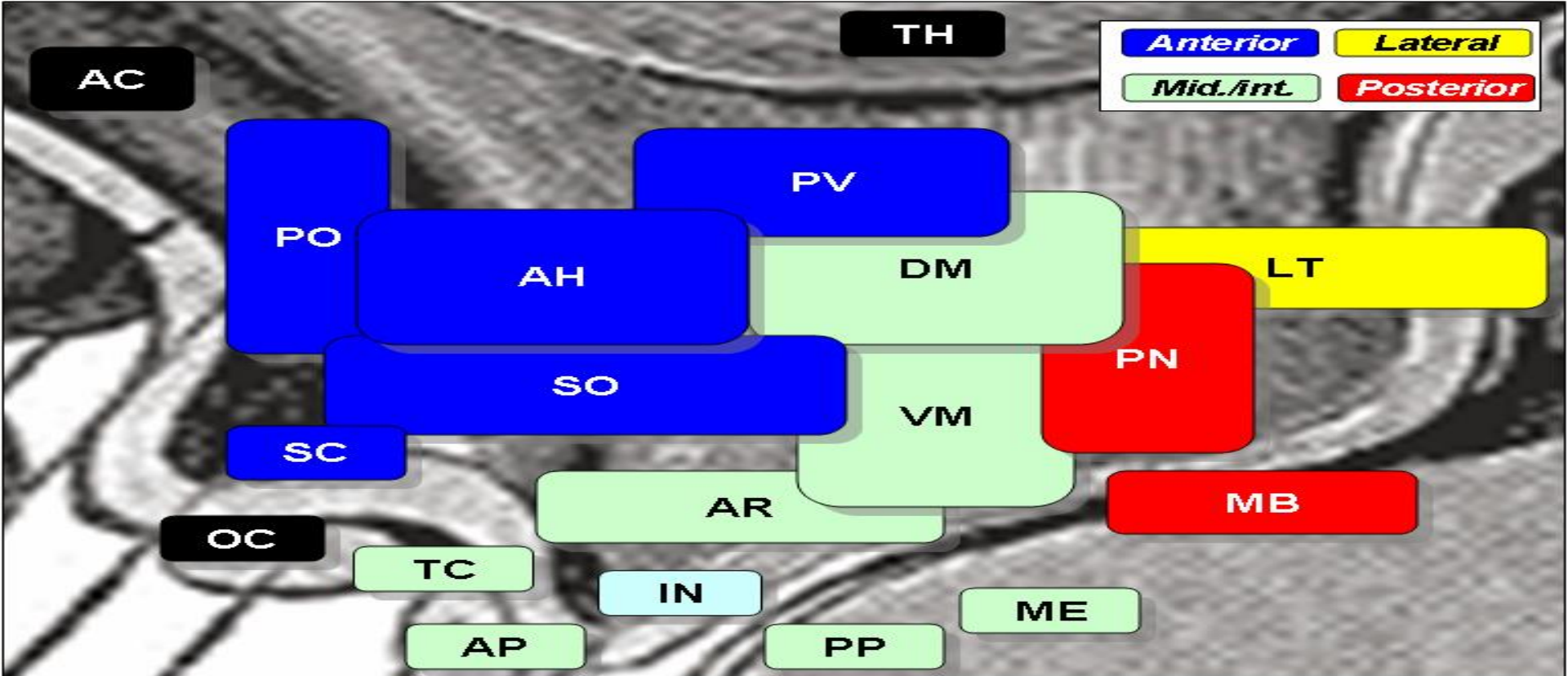
- **Coordinate.**
- **Thyroid gland, adrenal gland, reproductive gland, control growth, milk production, osmoregulation.**

# HYPOTHALAMUS

- **Control pituitary gland secretion.**
- **Composed of number of nerve cells.**







**Temperature Regulation**

The hypothalamus acts as the body's thermostat. It receives information from temperature-sensitive neurons in the skin and internal organs. When the body is too warm, the hypothalamus triggers responses like sweating and vasodilation to cool the body. When the body is too cold, it triggers responses like shivering and vasoconstriction to warm the body.

**Hunger and Thirst**

The hypothalamus contains the lateral hypothalamic area (LHA), which is involved in hunger, and the ventromedial nucleus (VMN), which is involved in satiety. The LHA sends signals to the brain to initiate eating behavior, while the VMN sends signals to inhibit eating. Similarly, the hypothalamus regulates thirst by monitoring the body's fluid balance and triggering the release of antidiuretic hormone (ADH) to conserve water.

**Neuroendocrine Control**

The hypothalamus is the master gland of the endocrine system. It secretes releasing and inhibiting hormones that control the anterior pituitary gland, which in turn controls the thyroid, parathyroid, and adrenal glands. The hypothalamus also produces and secretes oxytocin and vasopressin directly into the bloodstream.

**Other Functions**

- Emotion and Behavior:** The hypothalamus is involved in emotional responses and drives basic survival behaviors like eating, drinking, and sex.
- Autonomic Control:** It regulates the autonomic nervous system, controlling heart rate, blood pressure, and breathing.
- Reproduction:** The hypothalamus controls the reproductive system through the release of gonadotropin-releasing hormone (GnRH).

# HORMONES

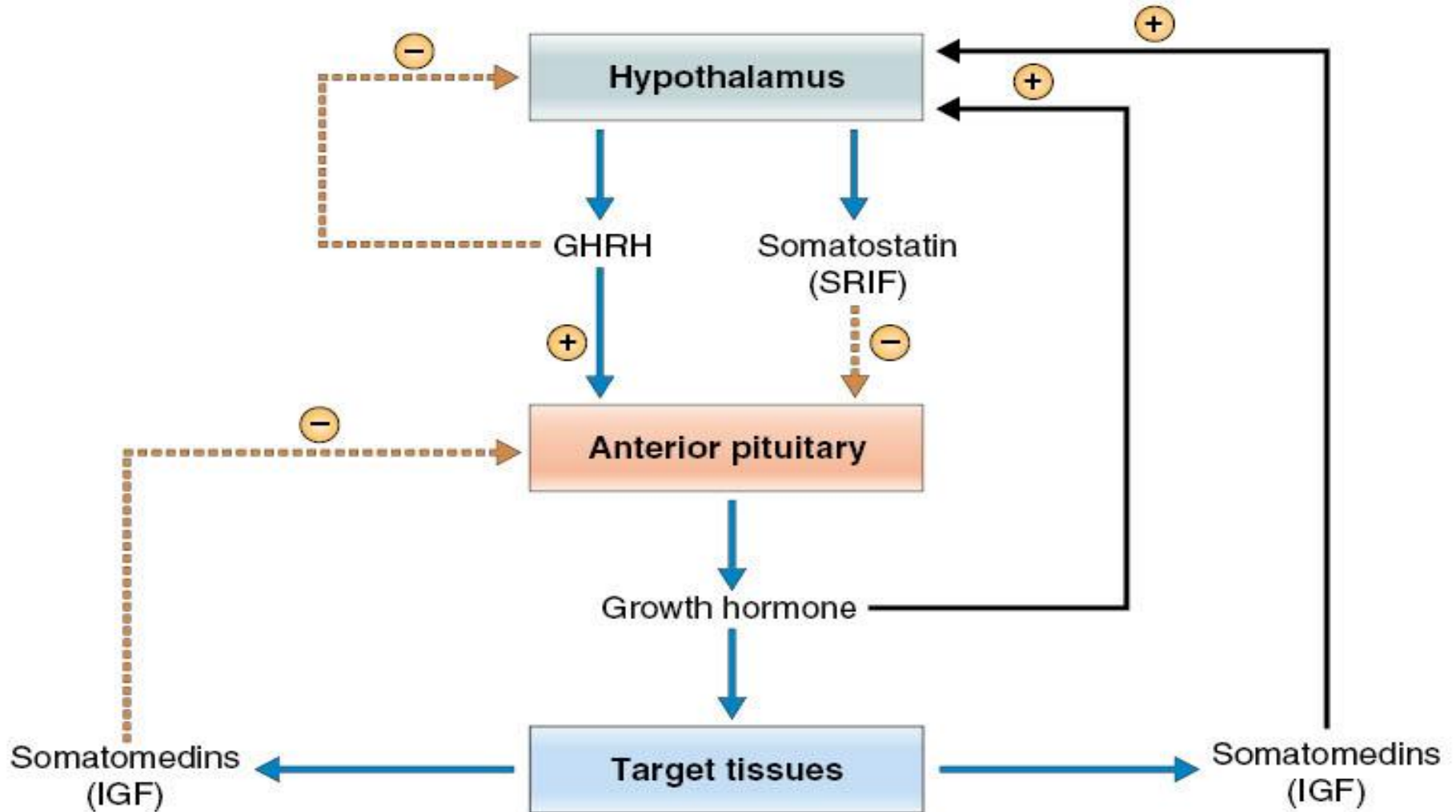
- TRH.
- CRH.
- GnRH.
- PIF.
- GHRH.

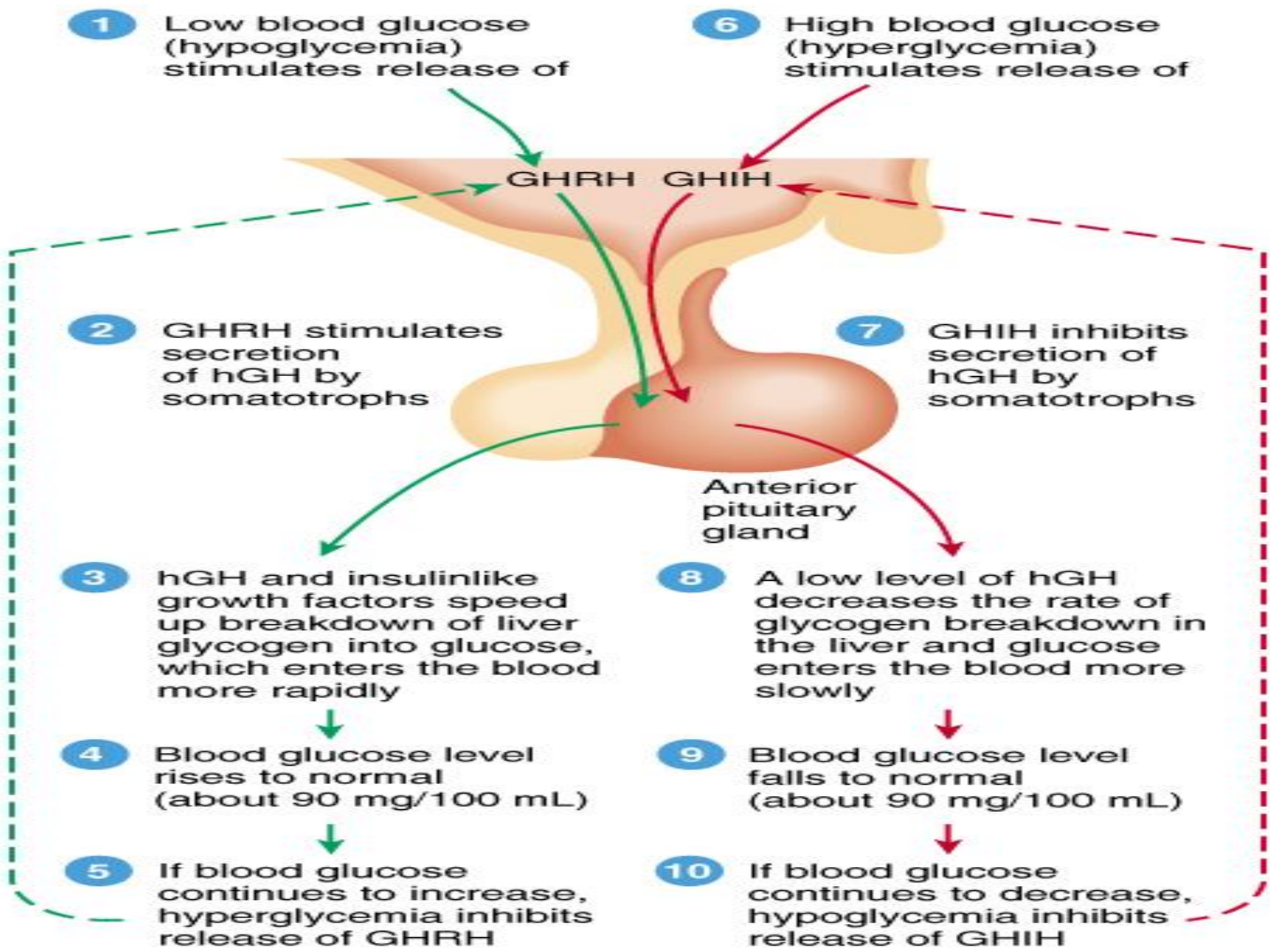


**Table 9-2** Summary of Endocrine Glands and Actions of Hormones

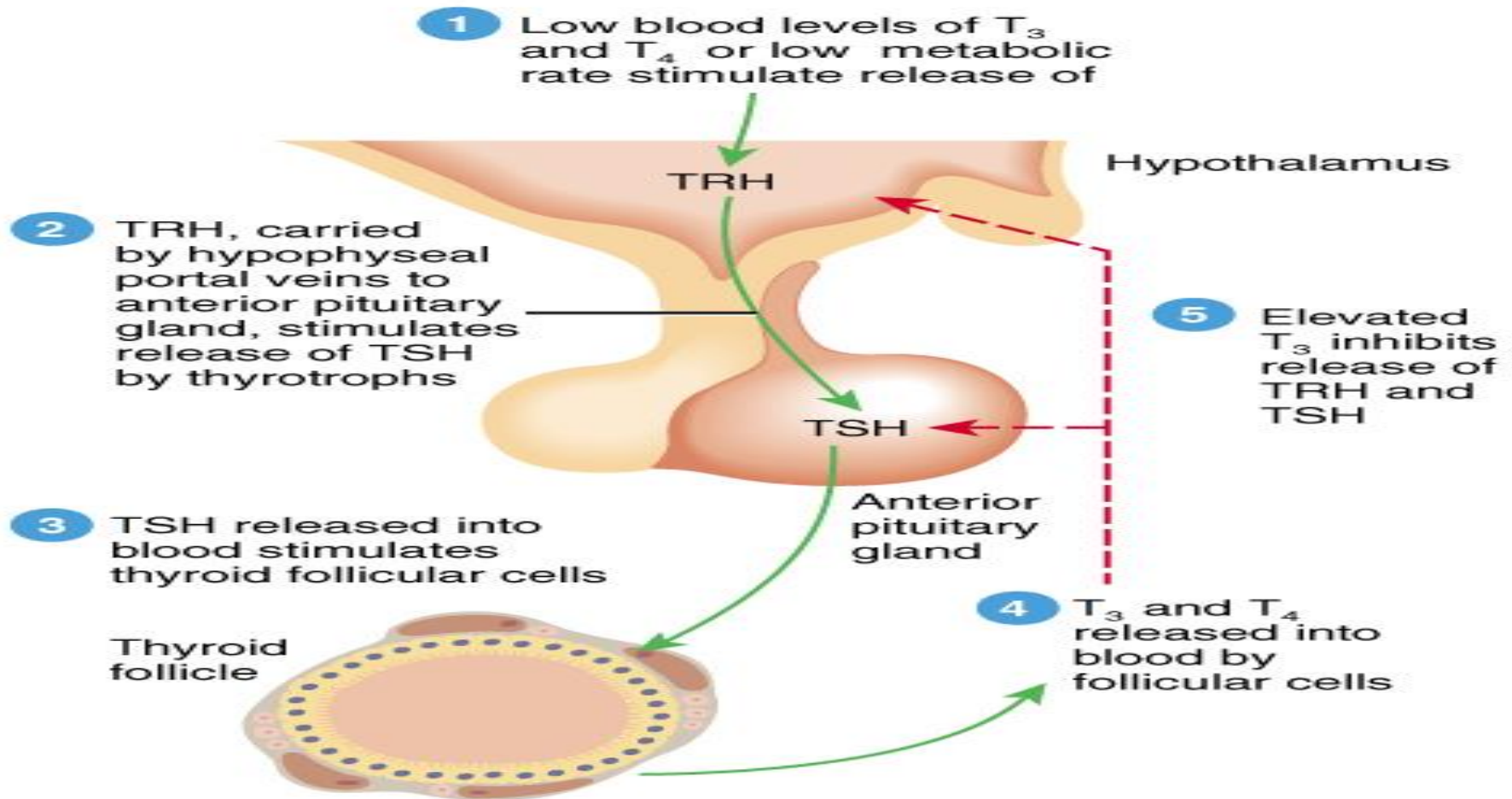
Gland of Origin	Hormones*	Chemical Classification†	Major Actions
<b>Hypothalamus</b>	Thyrotropin-releasing hormone (TRH)	Peptide	Stimulates secretion of TSH and prolactin
	Corticotropin-releasing hormone (CRH)	Peptide	Stimulates secretion of ACTH
	Gonadotropin-releasing hormone (GnRH)	Peptide	Stimulates secretion of LH and FSH
	Somatostatin or somatotropin release-inhibiting hormone (SRIF)	Peptide	Inhibits secretion of growth hormone
	Dopamine or prolactin-inhibiting factor (PIF)	Amine	Inhibits secretion of prolactin
	Growth hormone-releasing hormone (GHRH)	Peptide	Stimulates secretion of growth hormone

# GHRH/GHIH(SRIF)



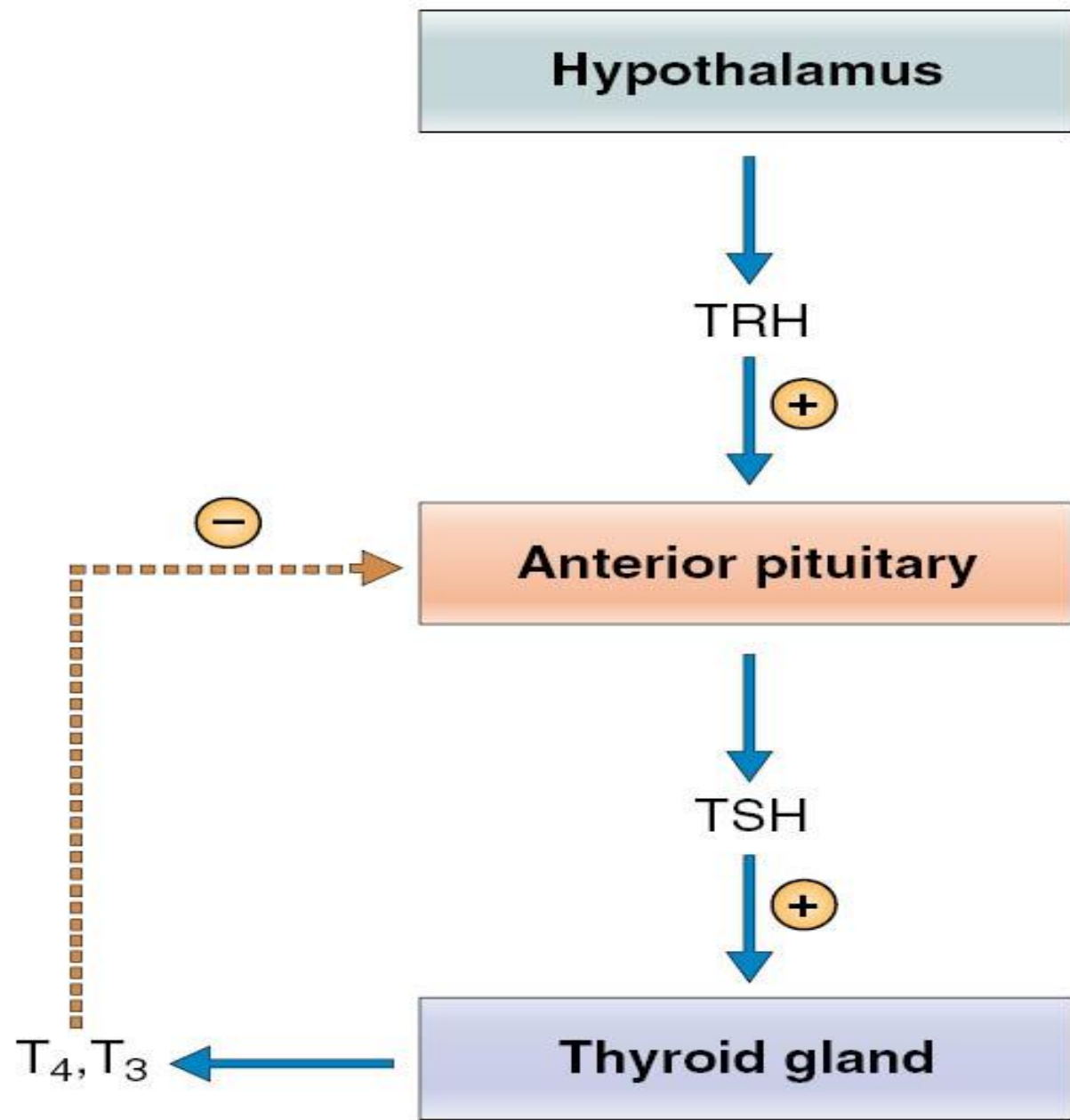


# TRH

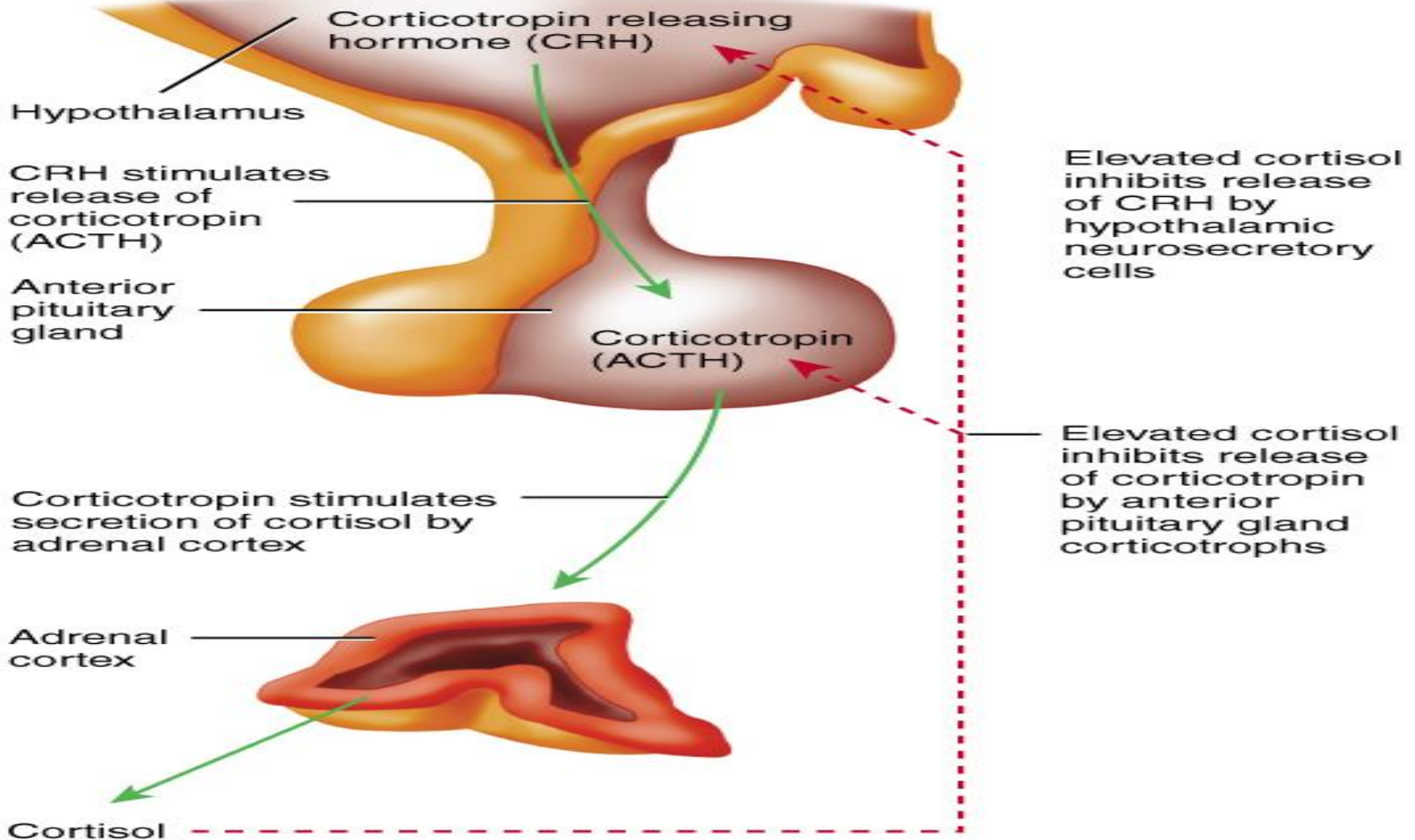


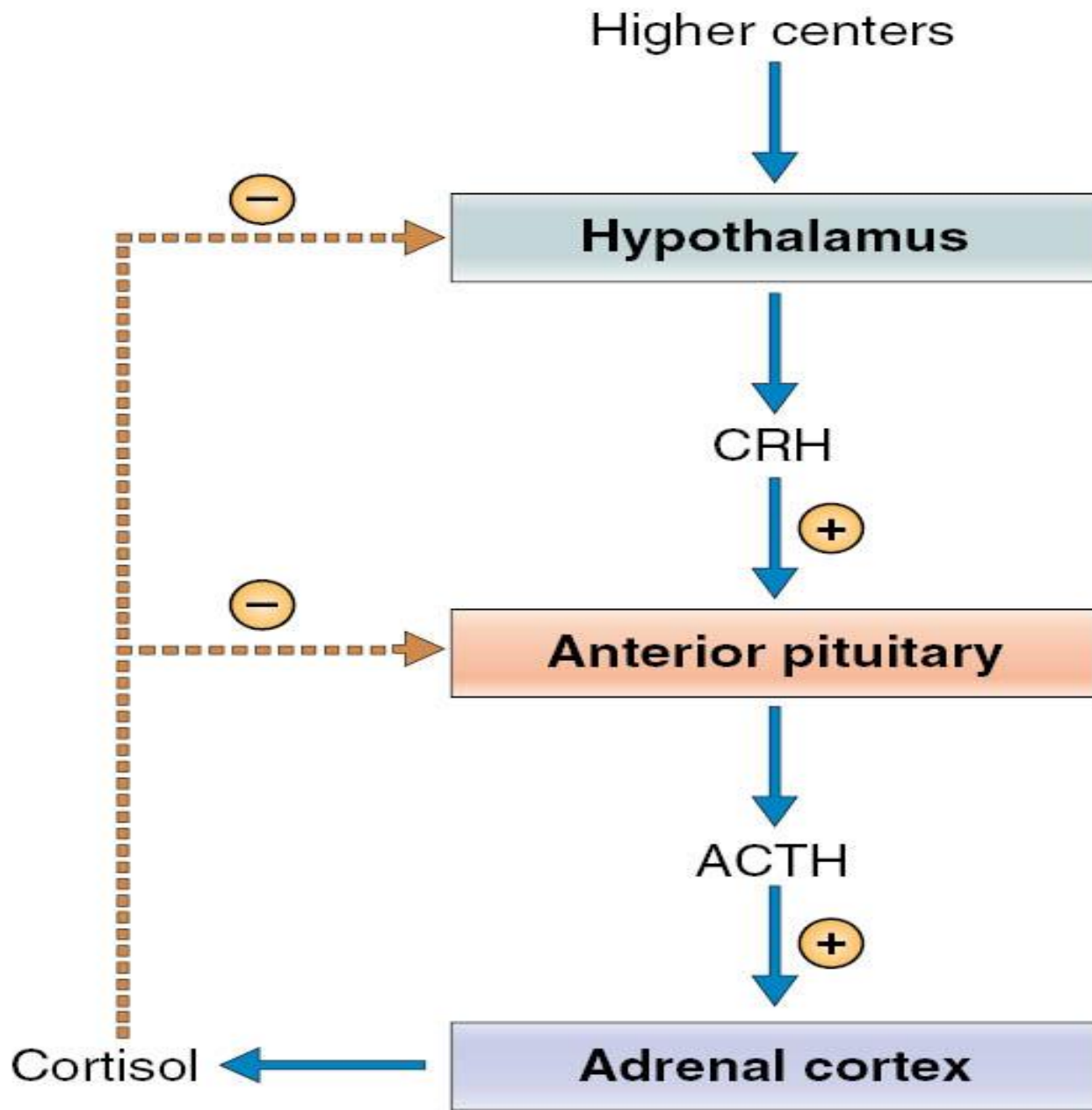
## Key:

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

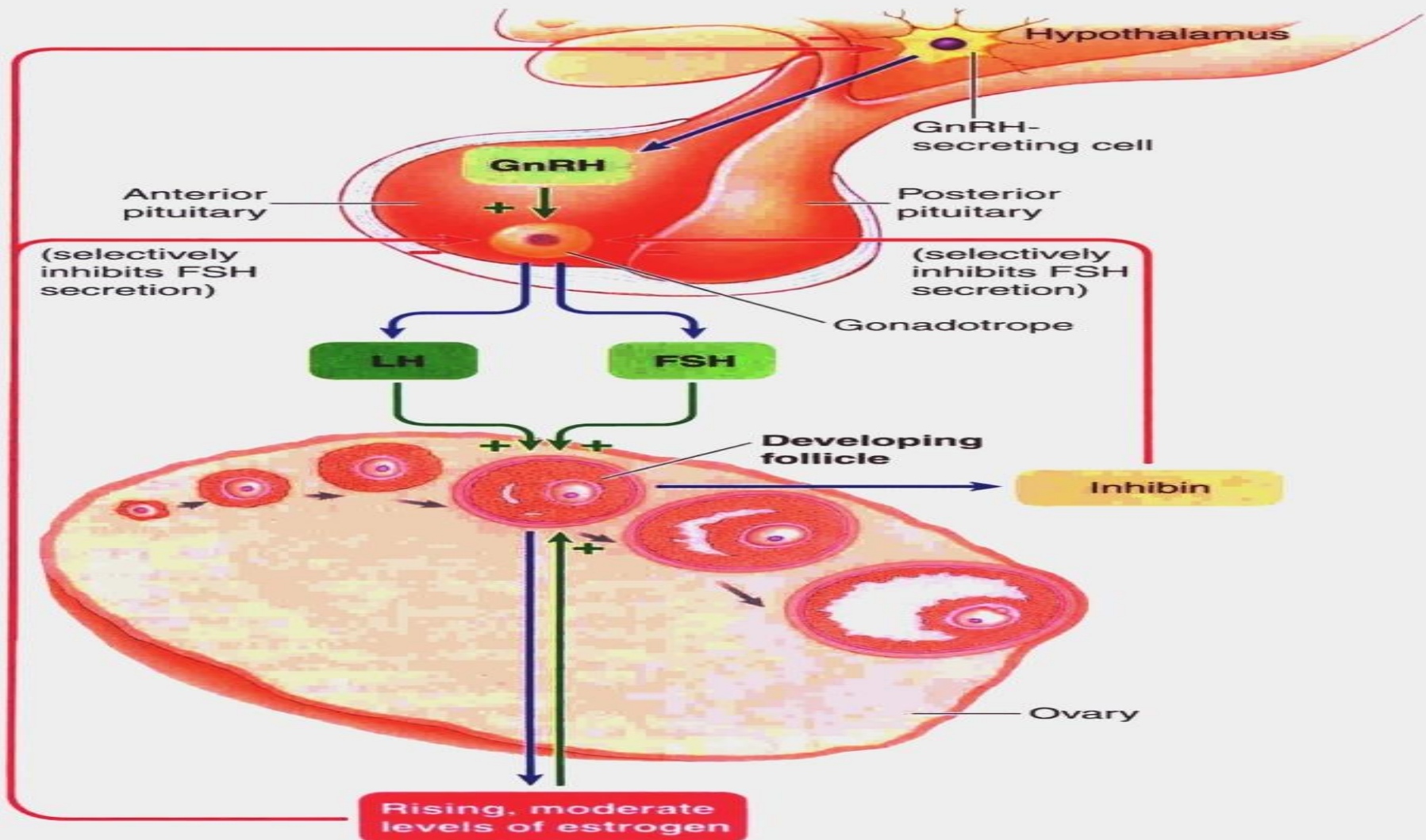


# CRH



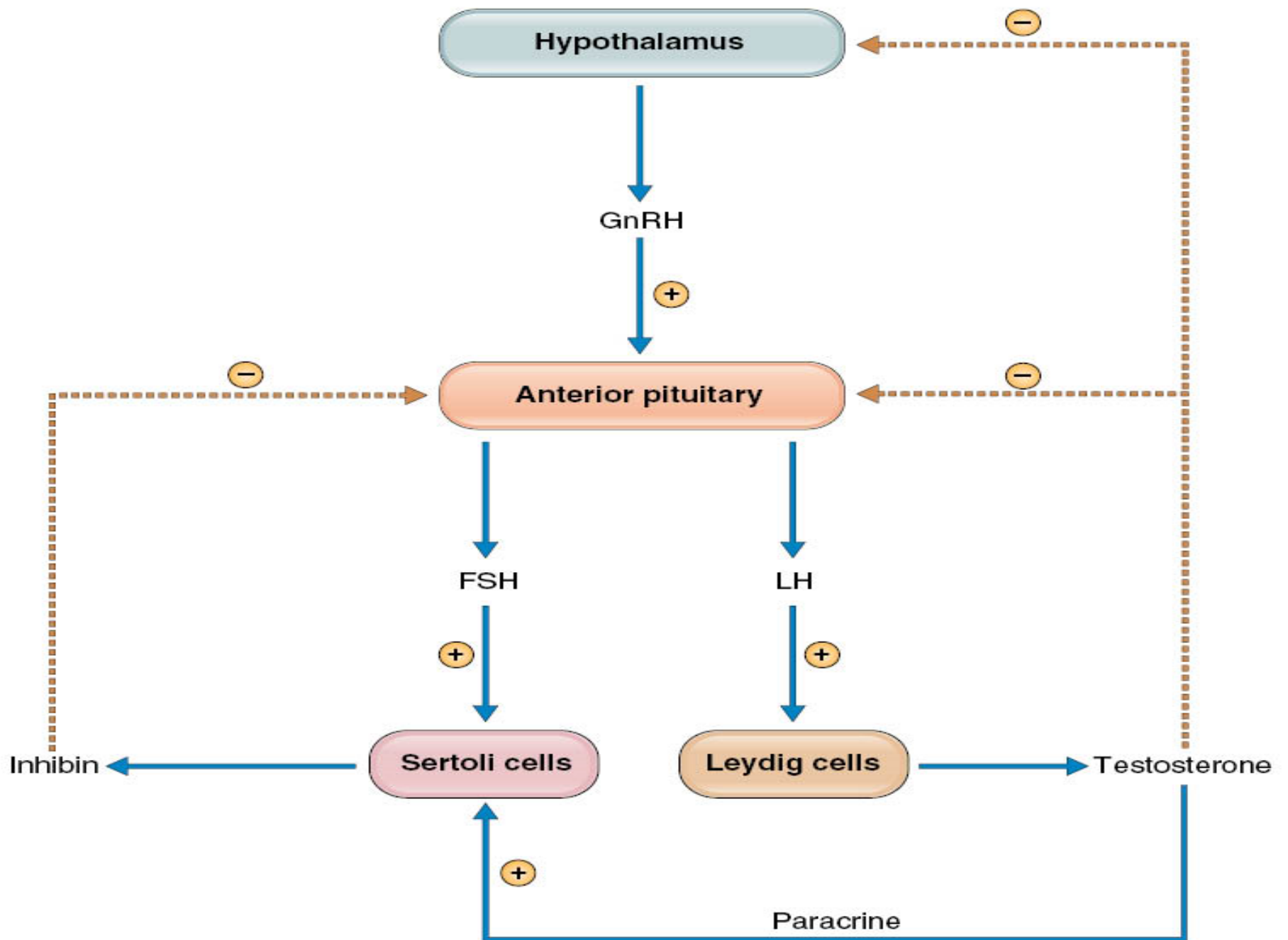


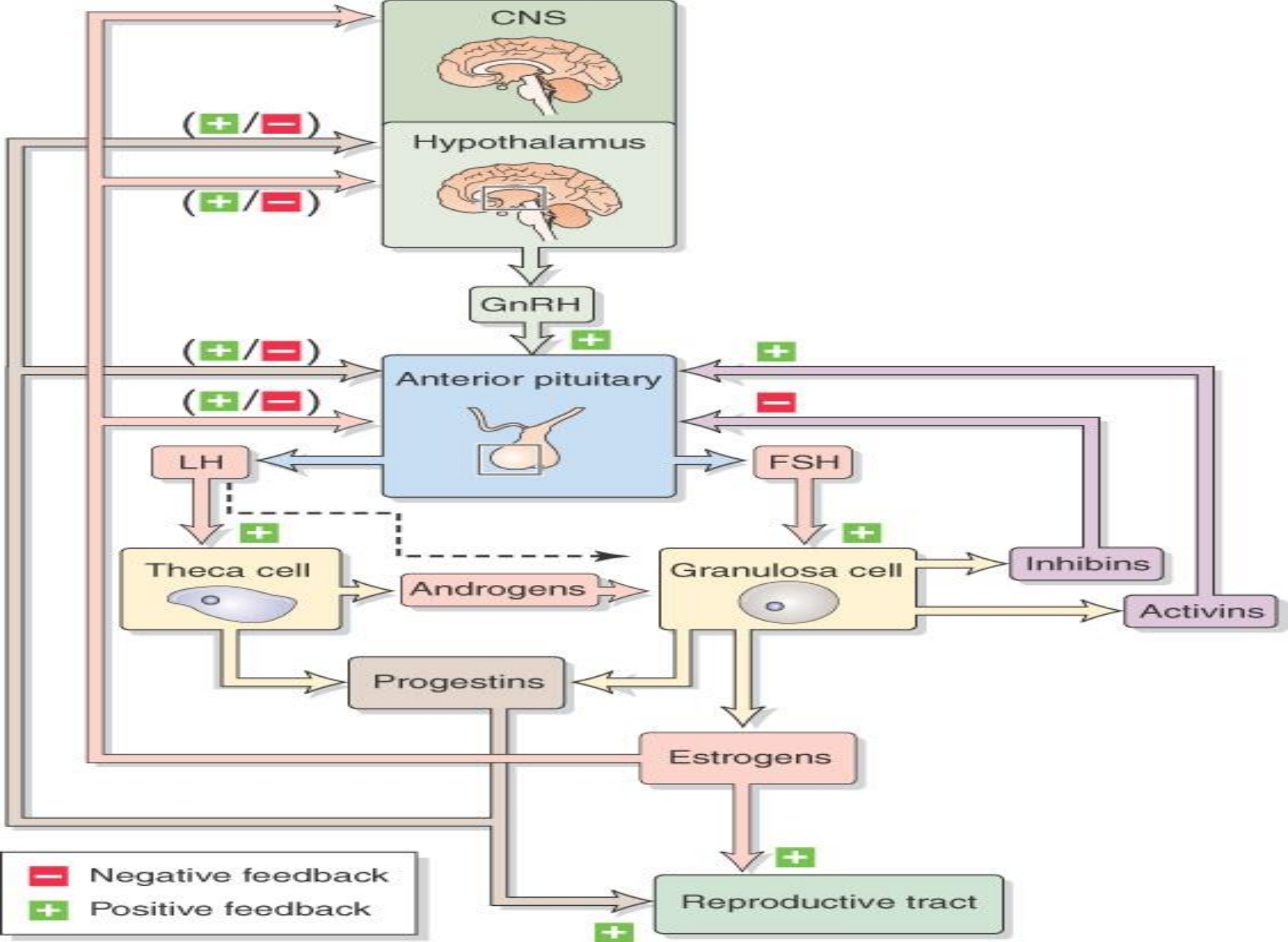
# GnRH



● **FIGURE 20-20** Feedback control of FSH and tonic LH secretion during the follicular phase.







# PIH

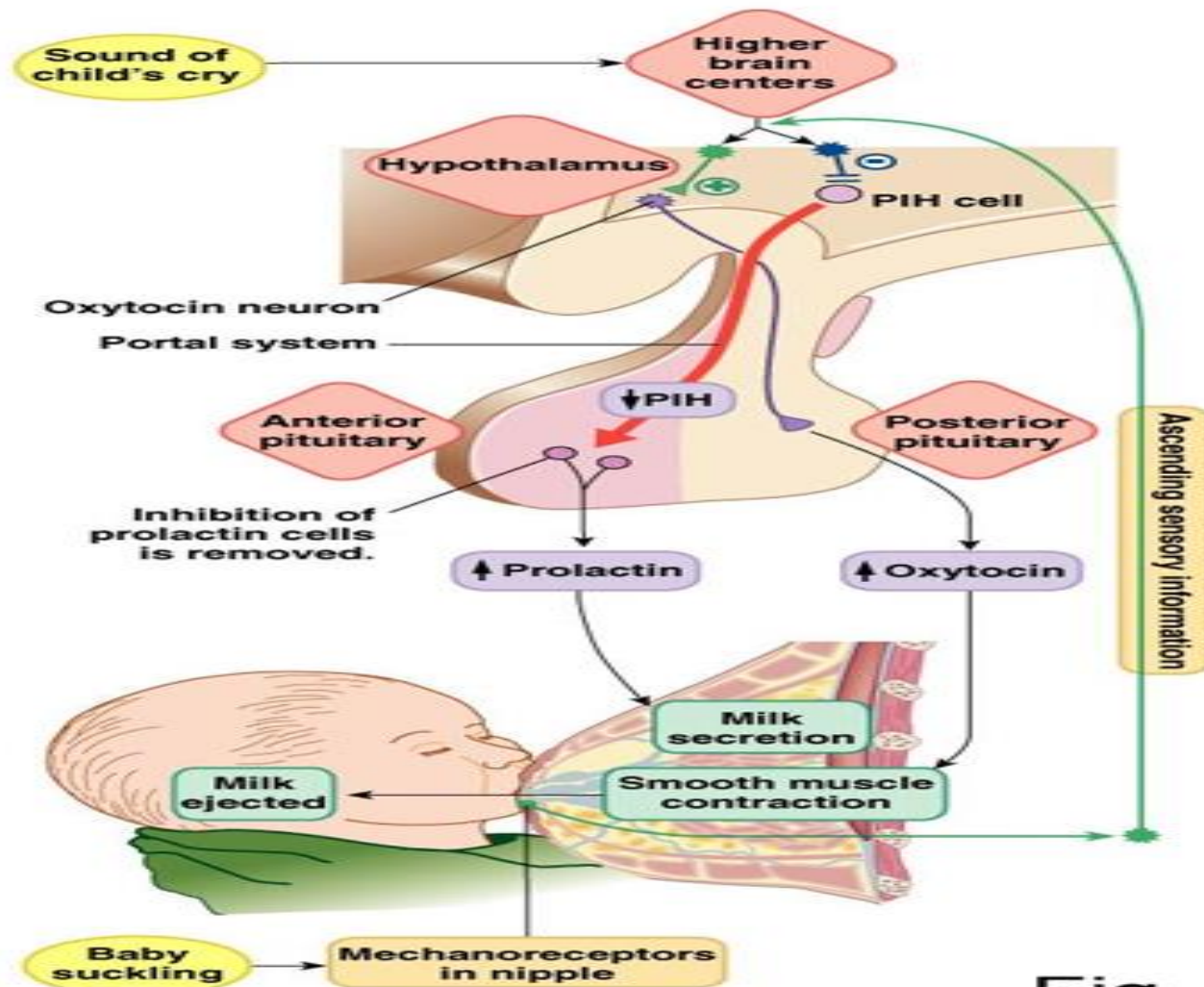
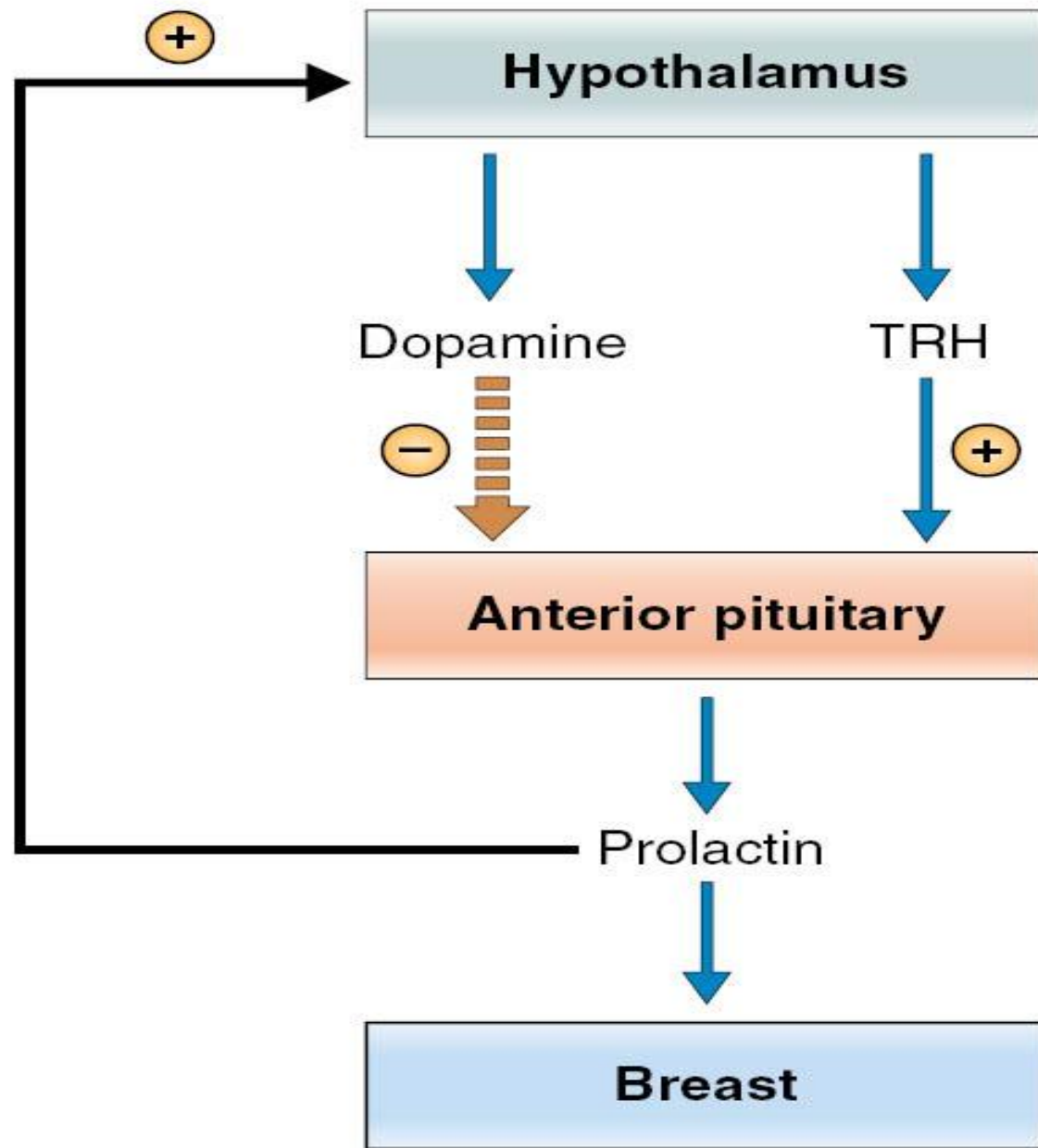
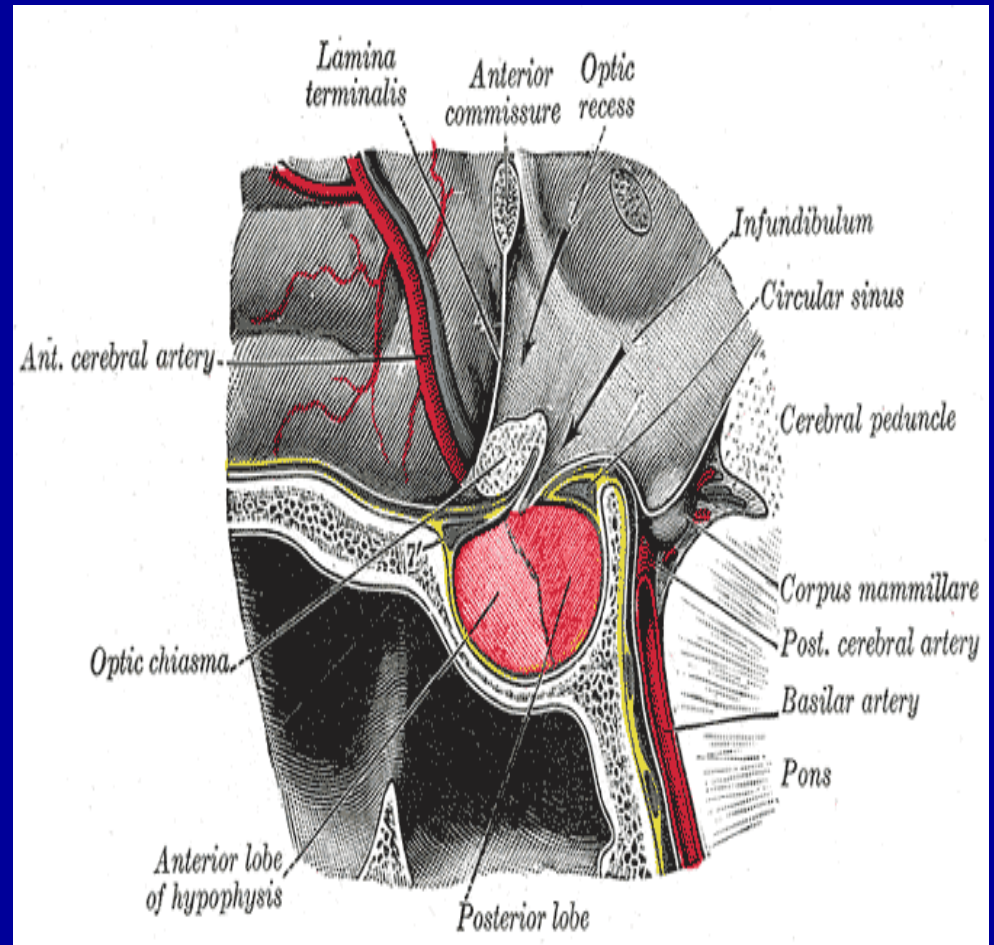


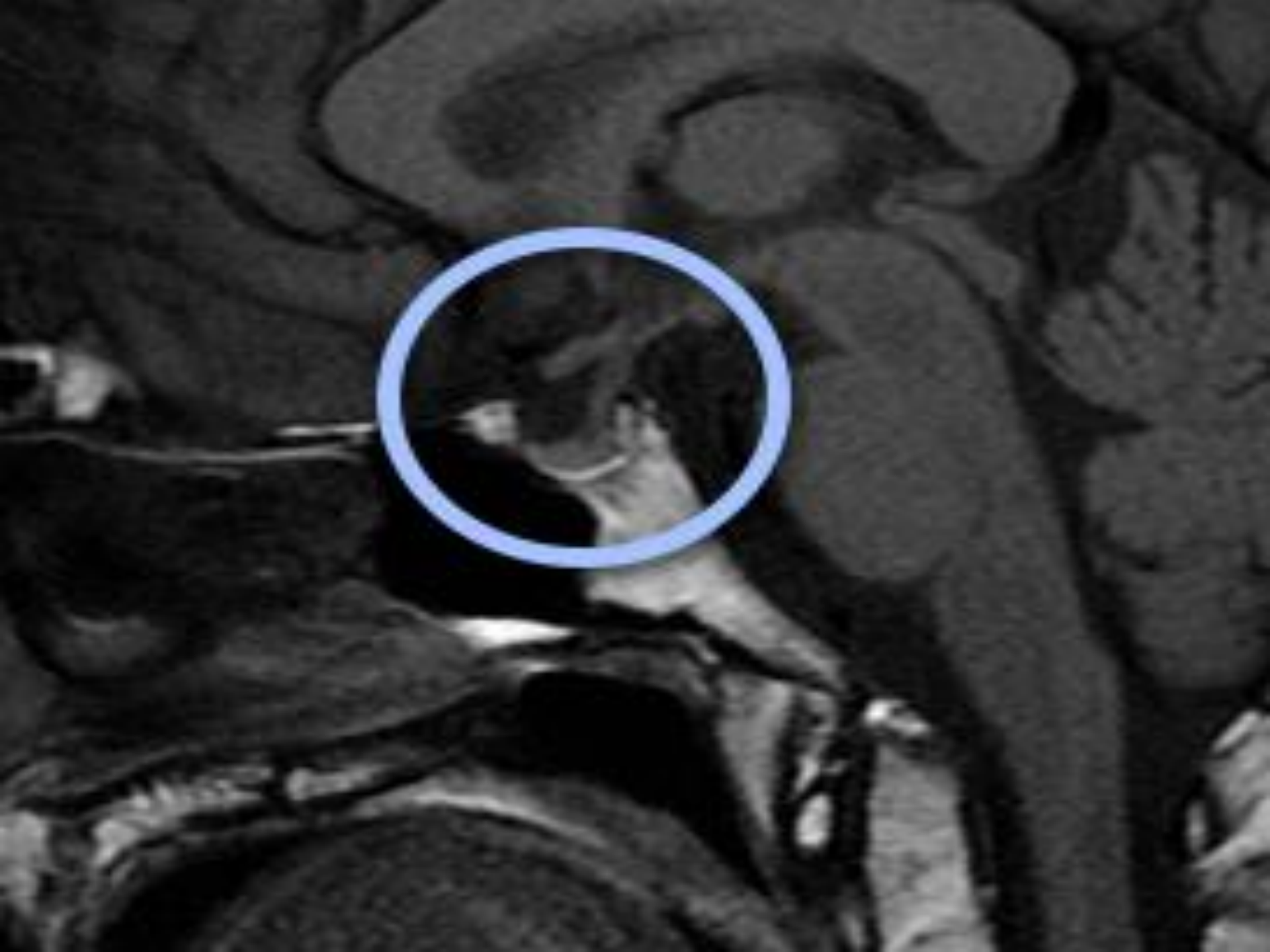
Fig. 26-23

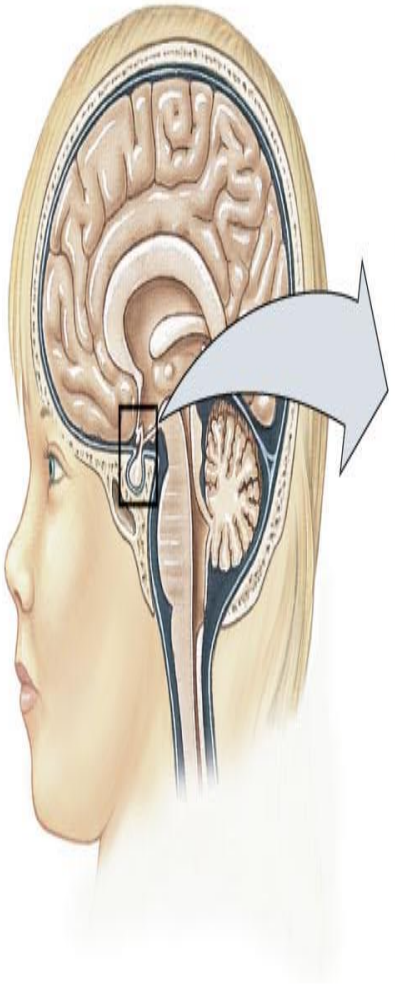


# PITUITARY GLAND

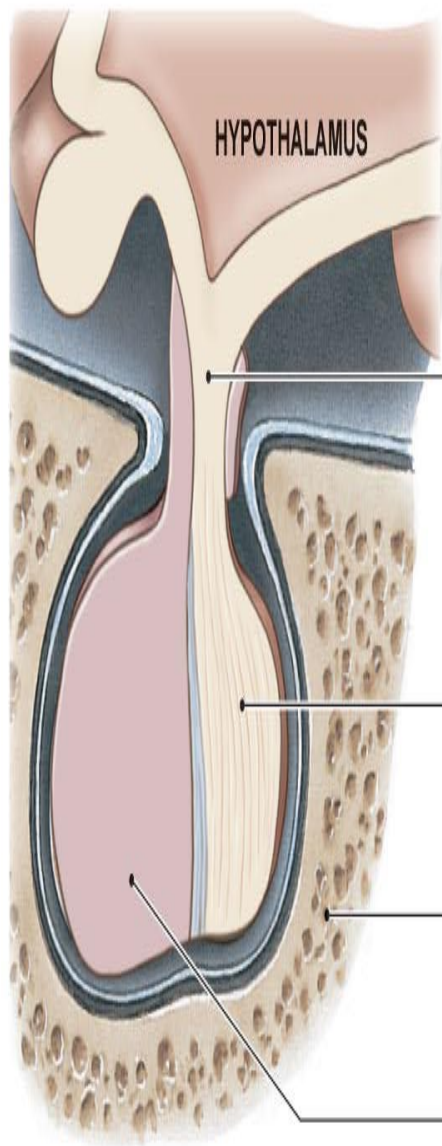
- Hypophysis.
- 1cm .
- 0.5-1 gram.







ANTERIOR ← → POSTERIOR



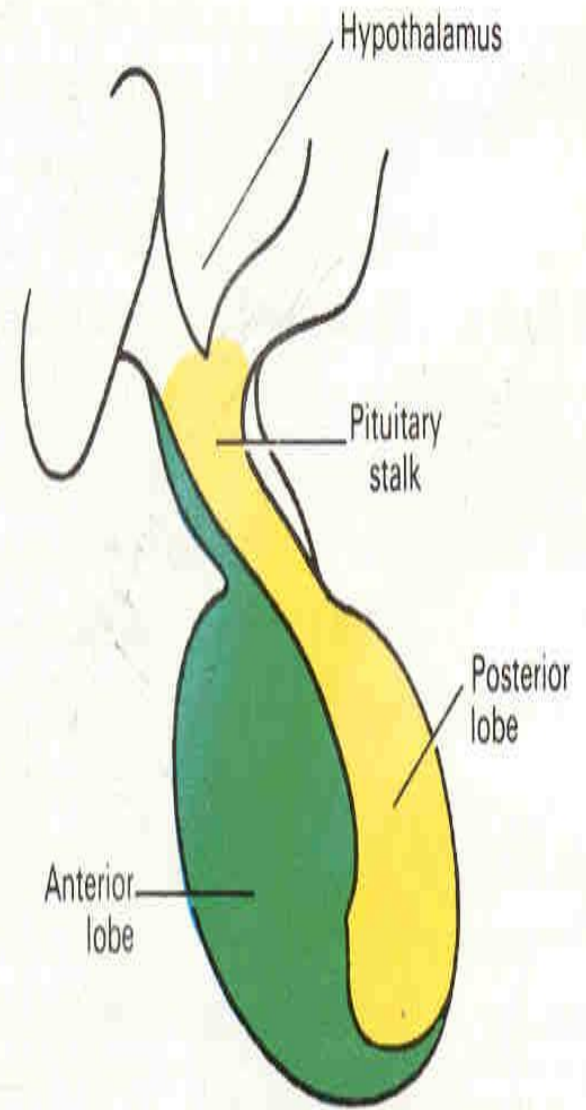
HYPOTHALAMUS

**Infundibulum** is the stalk that connects the pituitary to the brain.

**Posterior pituitary** is an extension of the neural tissue.

Sphenoid bone

**Anterior pituitary** is a true endocrine gland of epithelial origin.



Hypothalamus

Pituitary stalk

Posterior lobe

Anterior lobe

Figure 14:3 The parts of the pituitary gland and its relation to the hypothalamus.

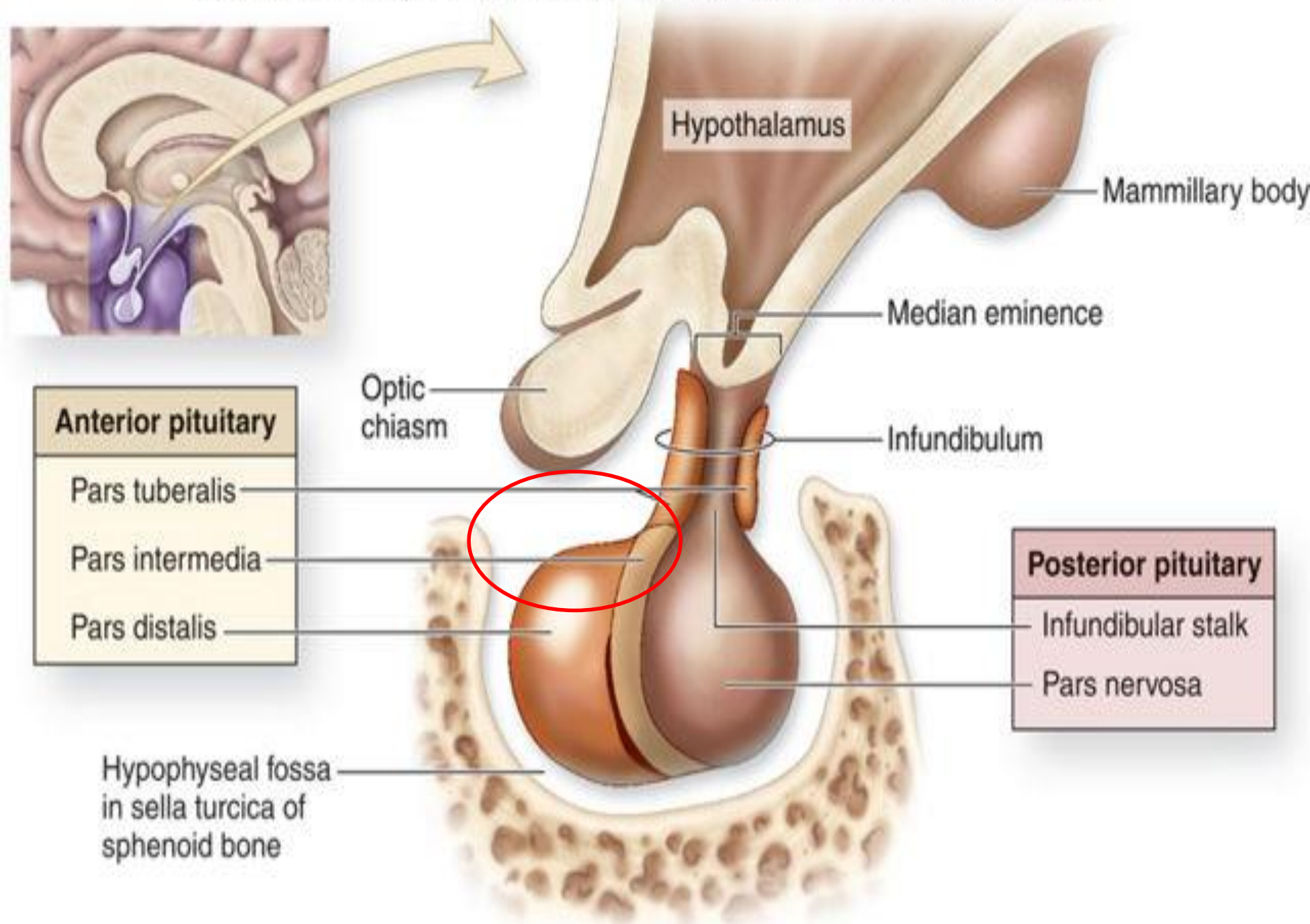
# STRUCTURE

**Anterior lobe (adenohypophysis).**

**Posterior lobe (neurohypophysis).**

**Infundibulum.**





# RELATIONSHIP OF THE HYPOTHALAMUS TO THE POSTERIOR PITUITARY

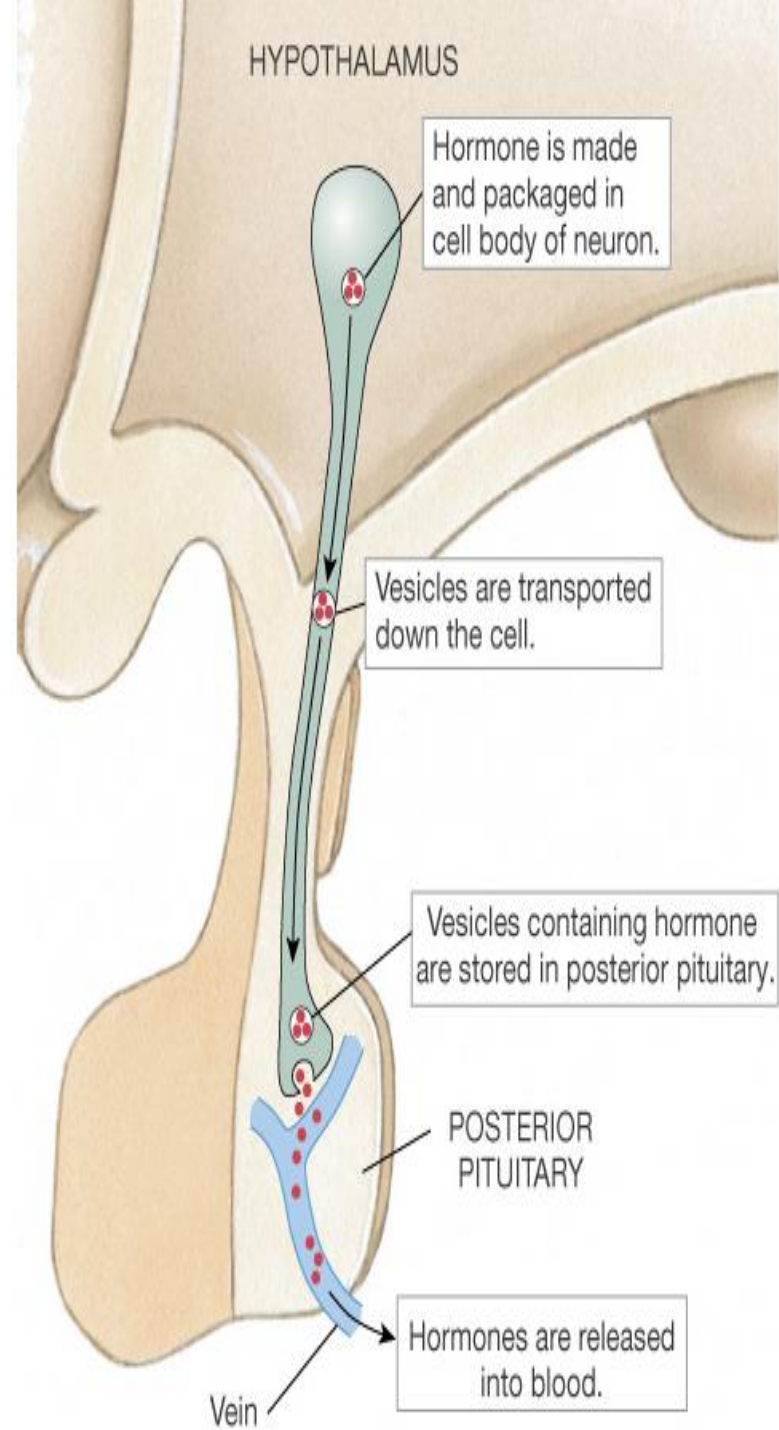
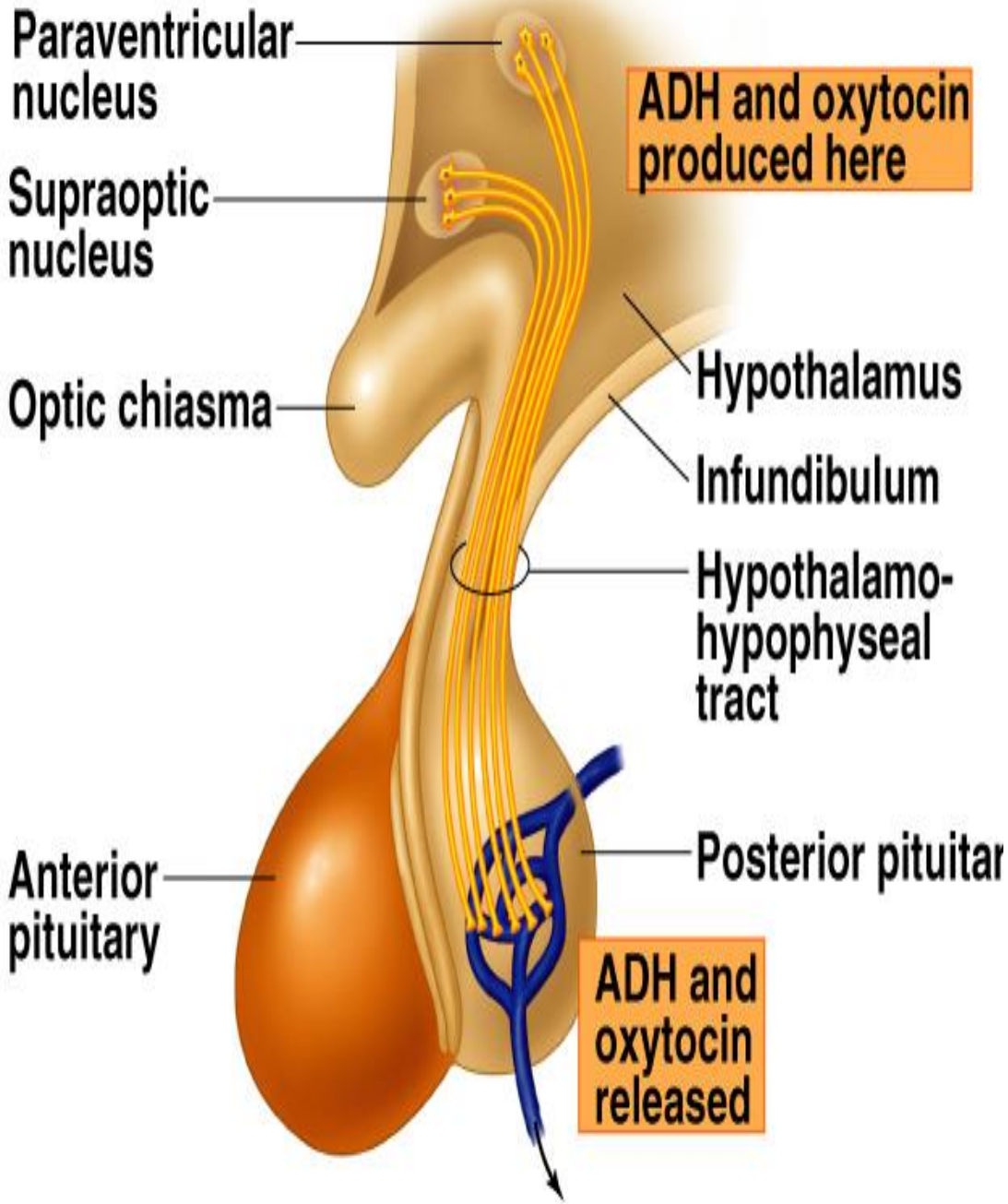
- Collection of nerve axons +supporting cells.

1- Antidiuretic hormone (ADH).

Supraoptic nuclei.

2- Oxytocin.

Paraventricular nuclei.



# HYPOTHALAMO-NEURO HYPOPHYSIAL TRACT

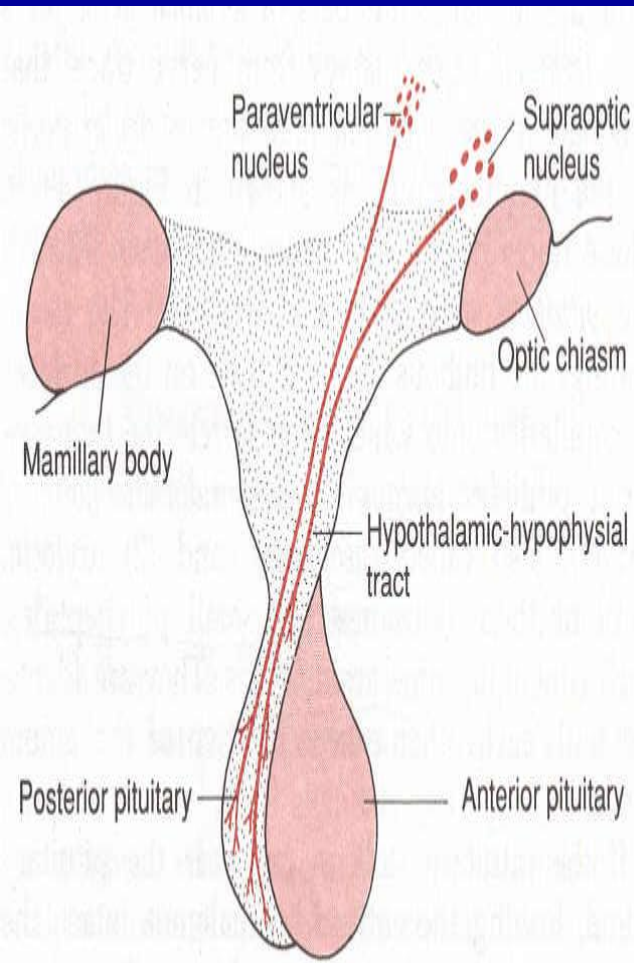
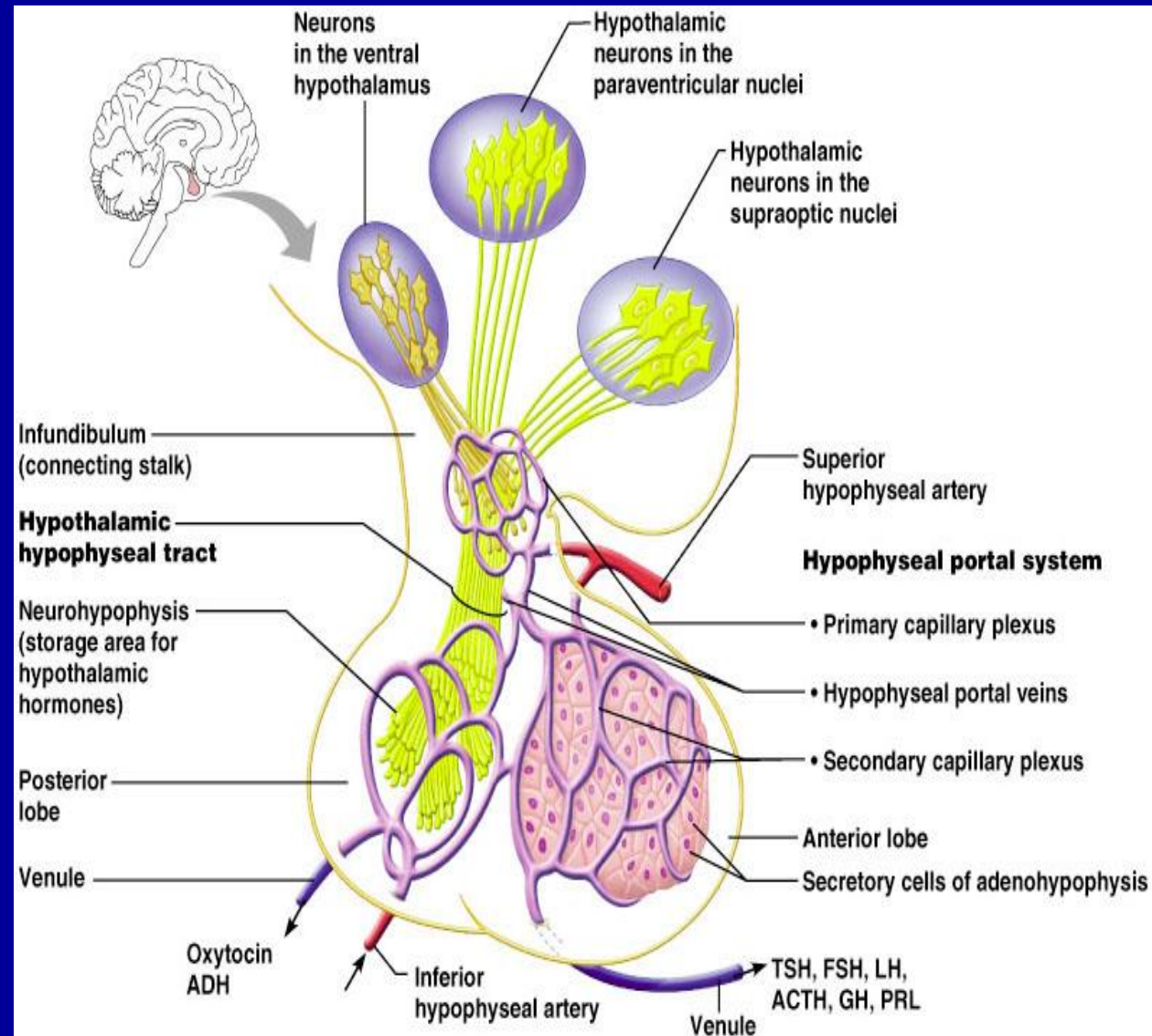


Figure 49-9 Hypothalamic control of the posterior pituitary.



# **RELATIONSHIP OF THE HYPOTHALAMUS TO THE ANTERIOR PITUITARY**

**collection of endocrine glands.**

**1- TSH**

**2- FSH**

**3- LH**

**4- GH**

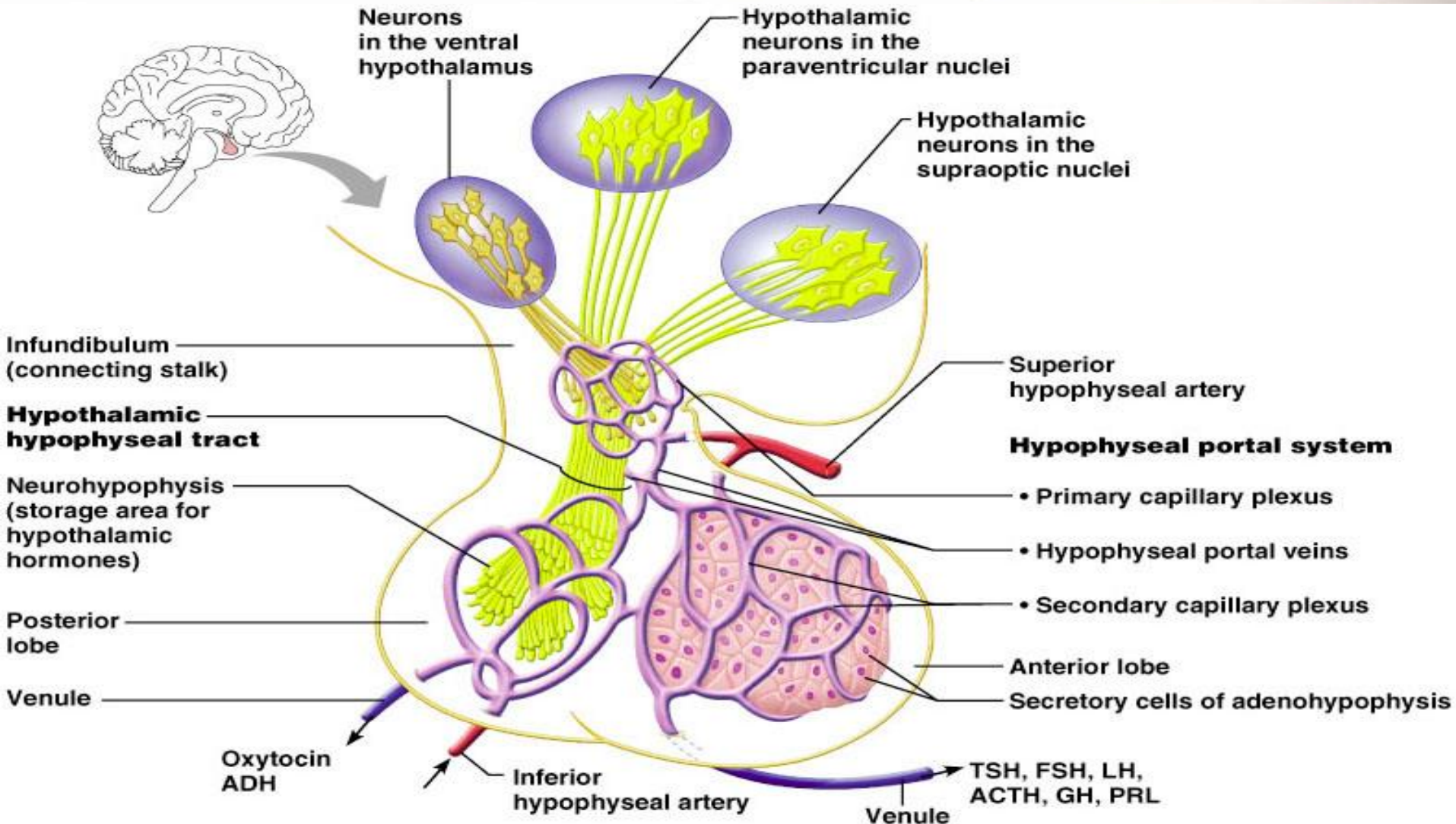
**5- PROLACTIN**

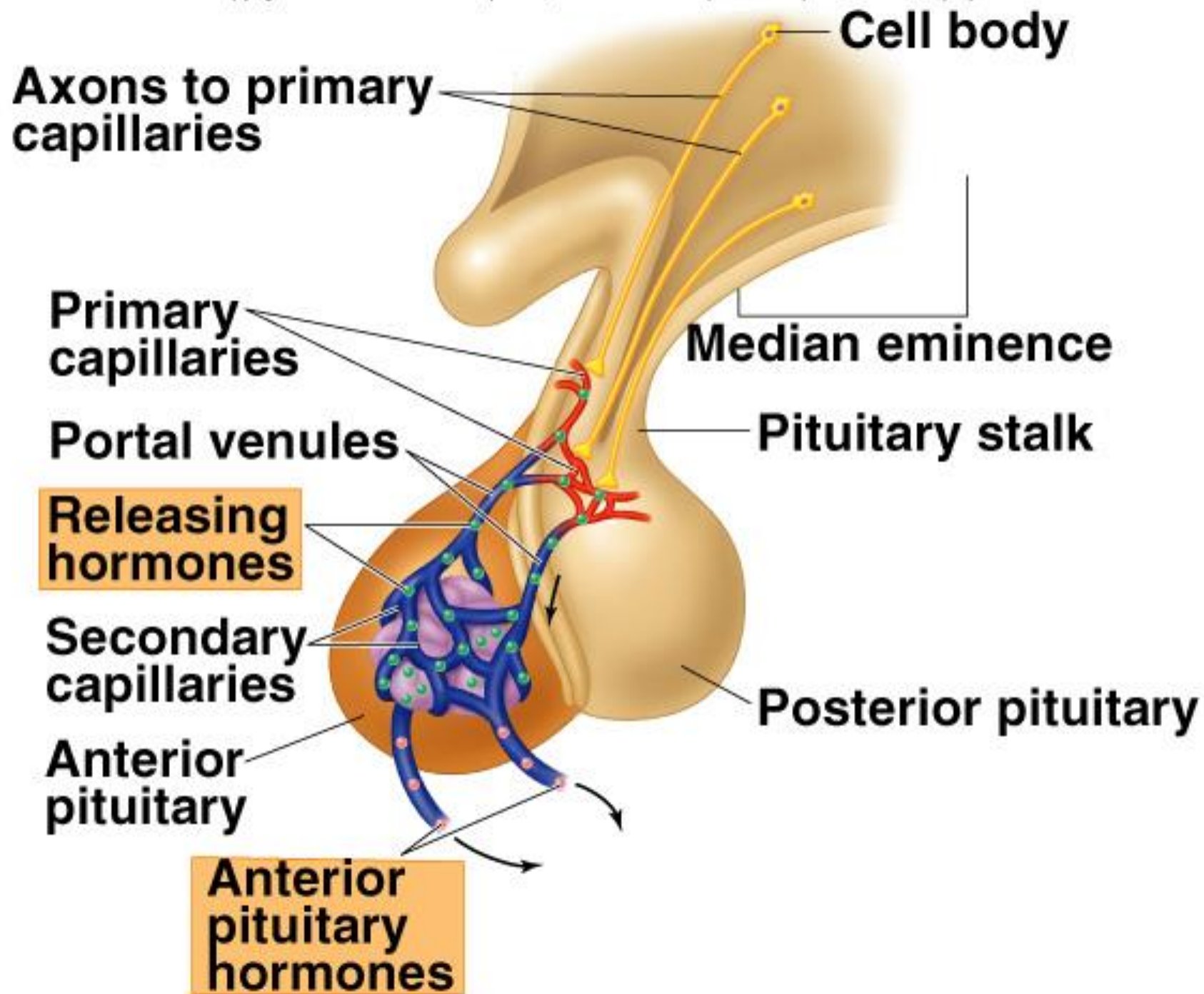
**6- ACTH.**

**Table 11.6 | Anterior Pituitary Hormones**

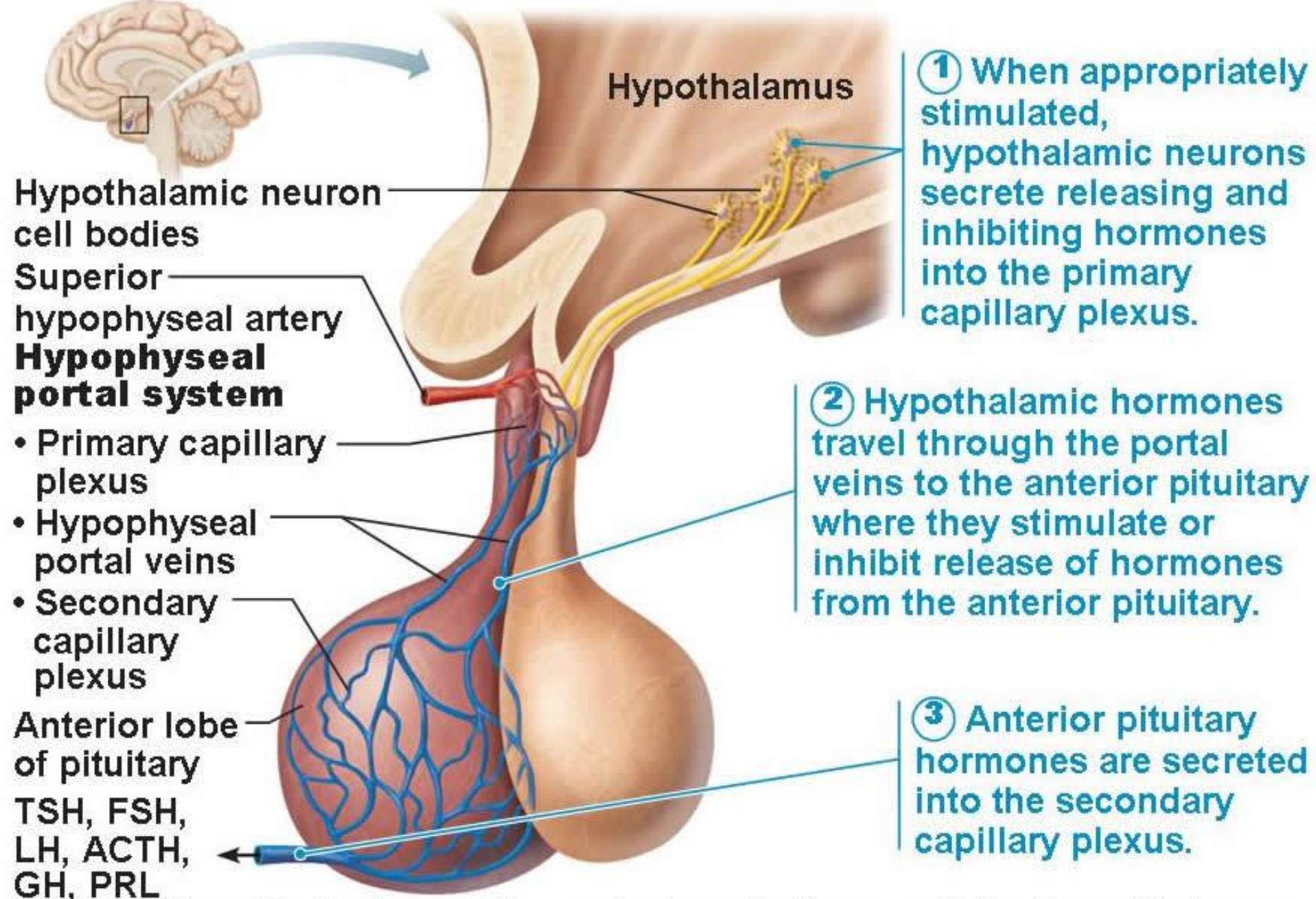
Hormone	Target Tissue	Principal Actions	Regulation of Secretion
ACTH (adrenocorticotrophic hormone)	Adrenal cortex	Stimulates secretion of glucocorticoids	Stimulated by CRH (corticotropin-releasing hormone); inhibited by glucocorticoids
TSH (thyroid-stimulating hormone)	Thyroid gland	Stimulates secretion of thyroid hormones	Stimulated by TRH (thyrotropin-releasing hormone); inhibited by thyroid hormones
GH (growth hormone)	Most tissue	Promotes protein synthesis and growth; lipolysis and increased blood glucose	Inhibited by somatostatin; stimulated by growth hormone-releasing hormone
FSH (follicle-stimulating hormone)	Gonads	Promotes gamete production and stimulates estrogen production in females	Stimulated by GnRH (gonadotropin-releasing hormone); inhibited by sex steroids and inhibin
PRL (prolactin)	Mammary glands and other sex accessory organs	Promotes milk production in lactating females; additional actions in other organs	Inhibited by PIH (prolactin-inhibiting hormone)
LH (luteinizing hormone)	Gonads	Stimulates sex hormone secretion; ovulation and corpus luteum formation in females; stimulates testosterone secretion in males	Stimulated by GnRH; inhibited by sex steroids

# HYPOTHALAMIC-HYPOPHYSIAL PORTAL SYSTEM





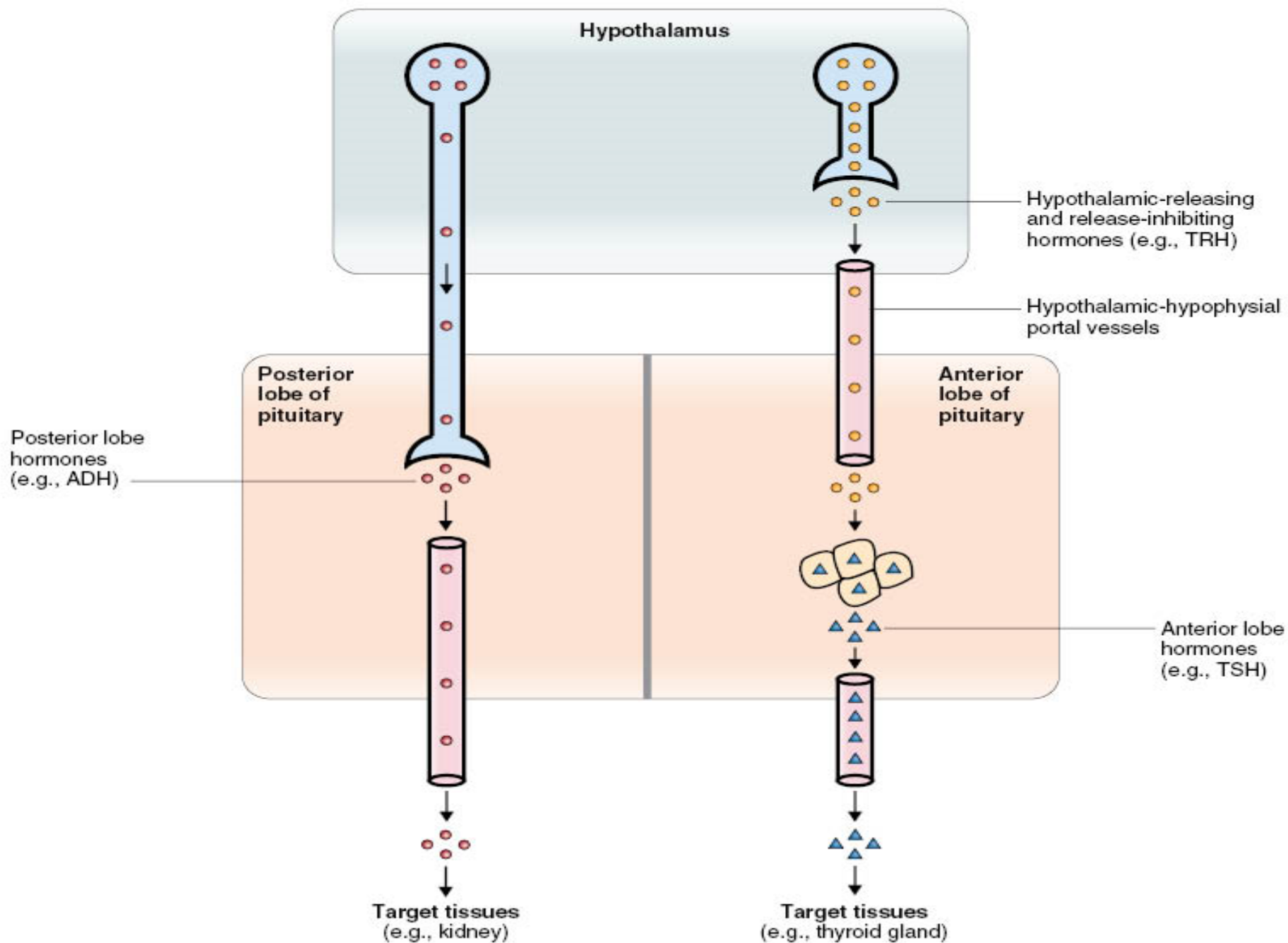




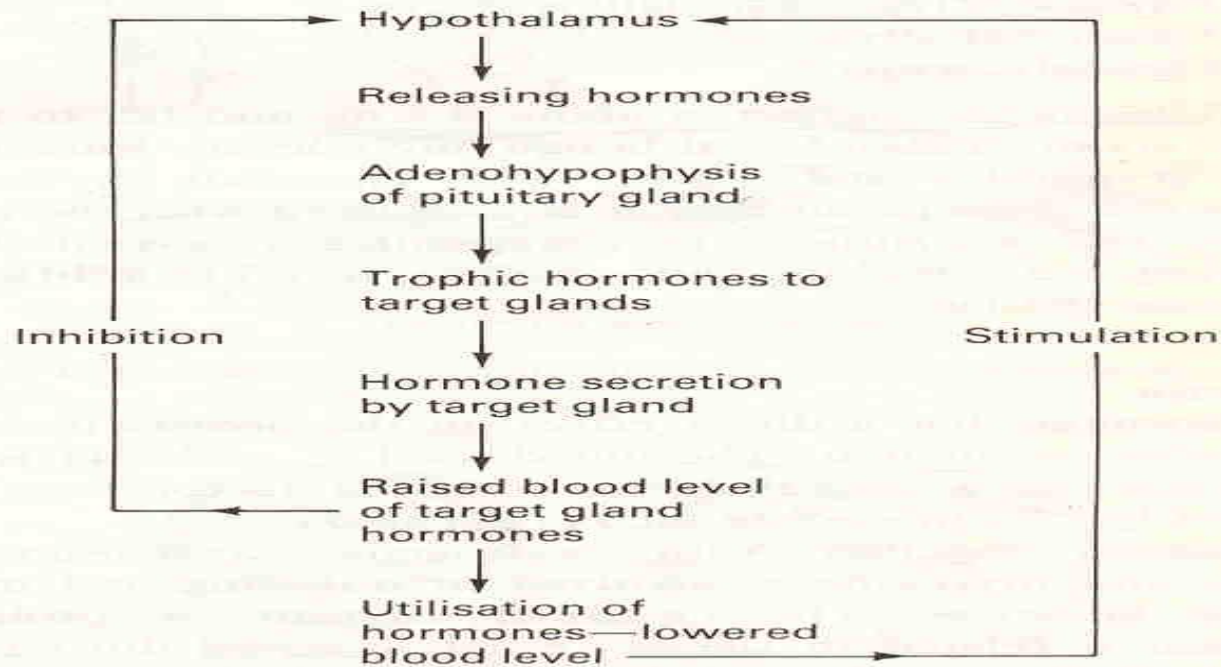
**(b) Relationship between the anterior pituitary and the hypothalamus**

- **Both neural and endocrine.**

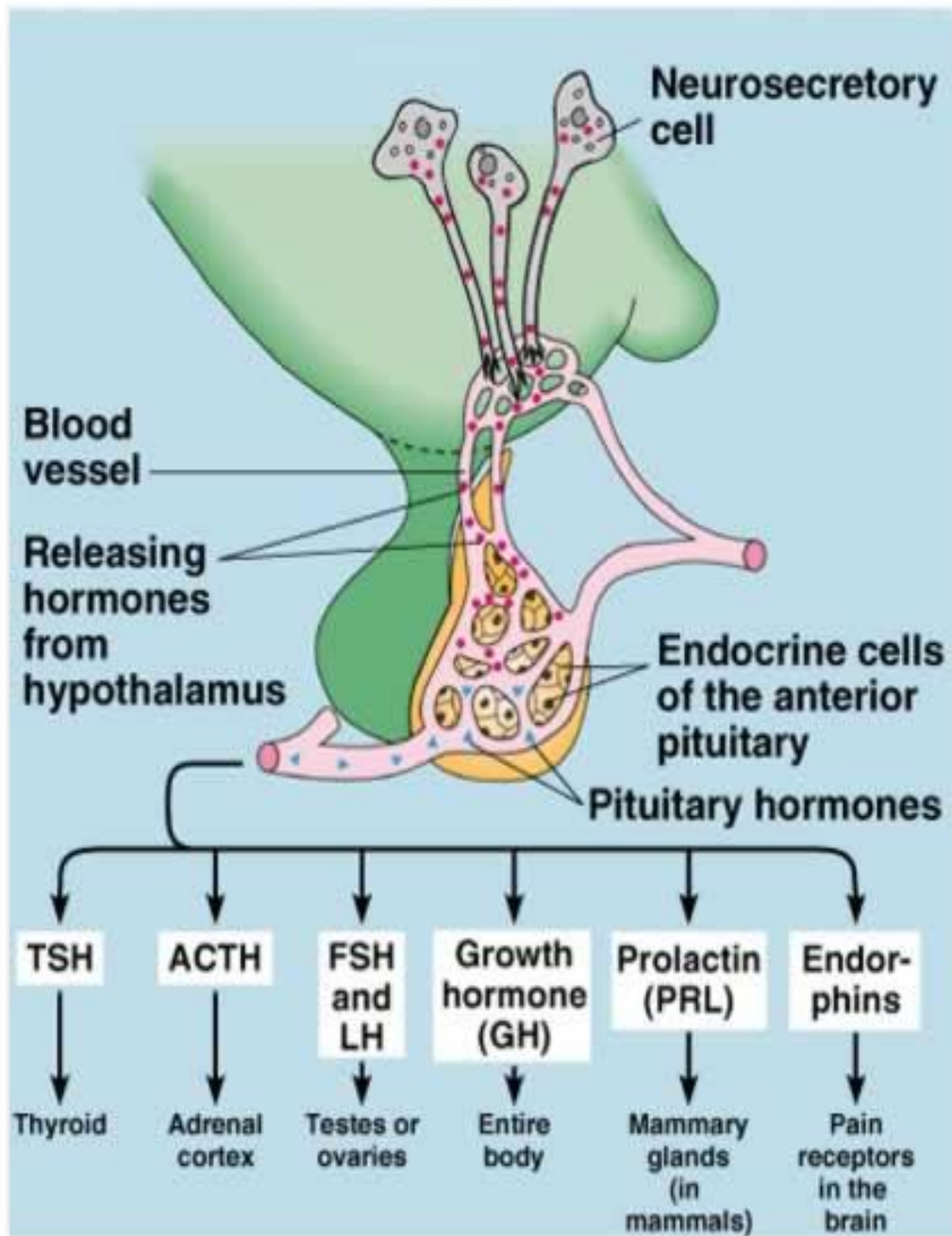
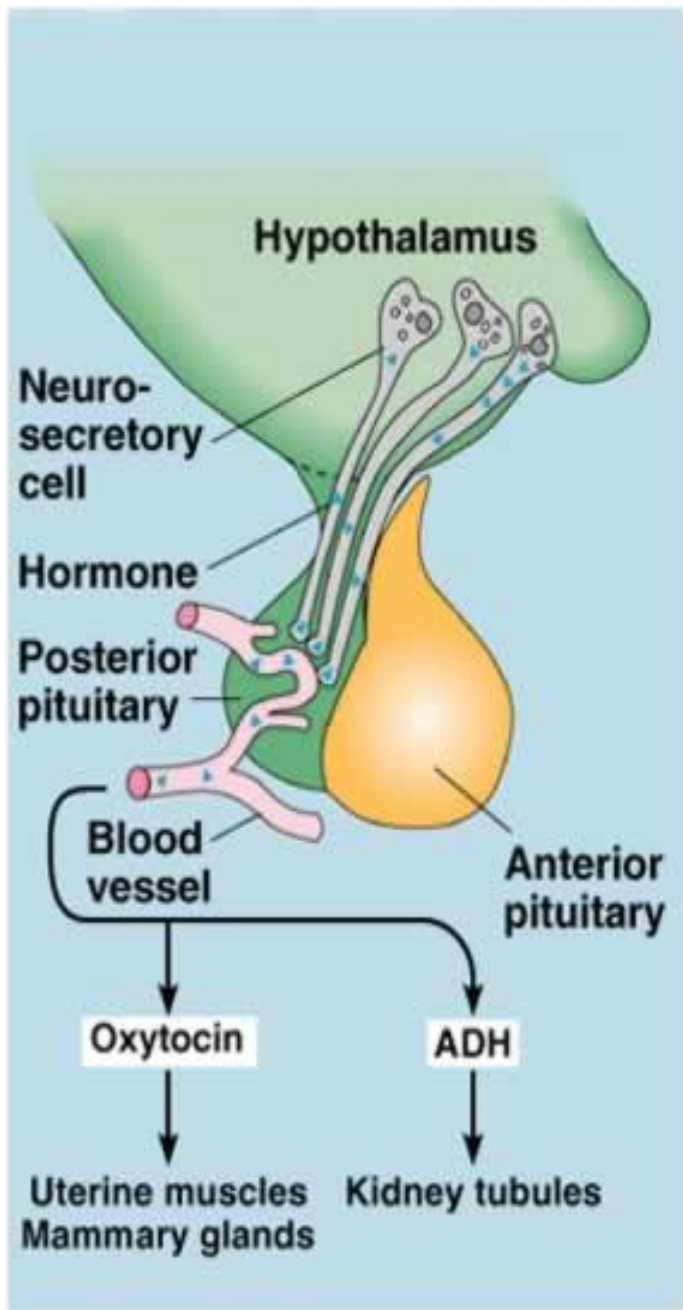
# HYPOTHALAMIC-PITUITARY RELATIONSHIPS



# NEGATIVE FEEDBACK MECHANISM



**Figure 14:4** Diagram of the negative feedback regulation of the secretions of hormones by the anterior lobe of the pituitary gland.



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