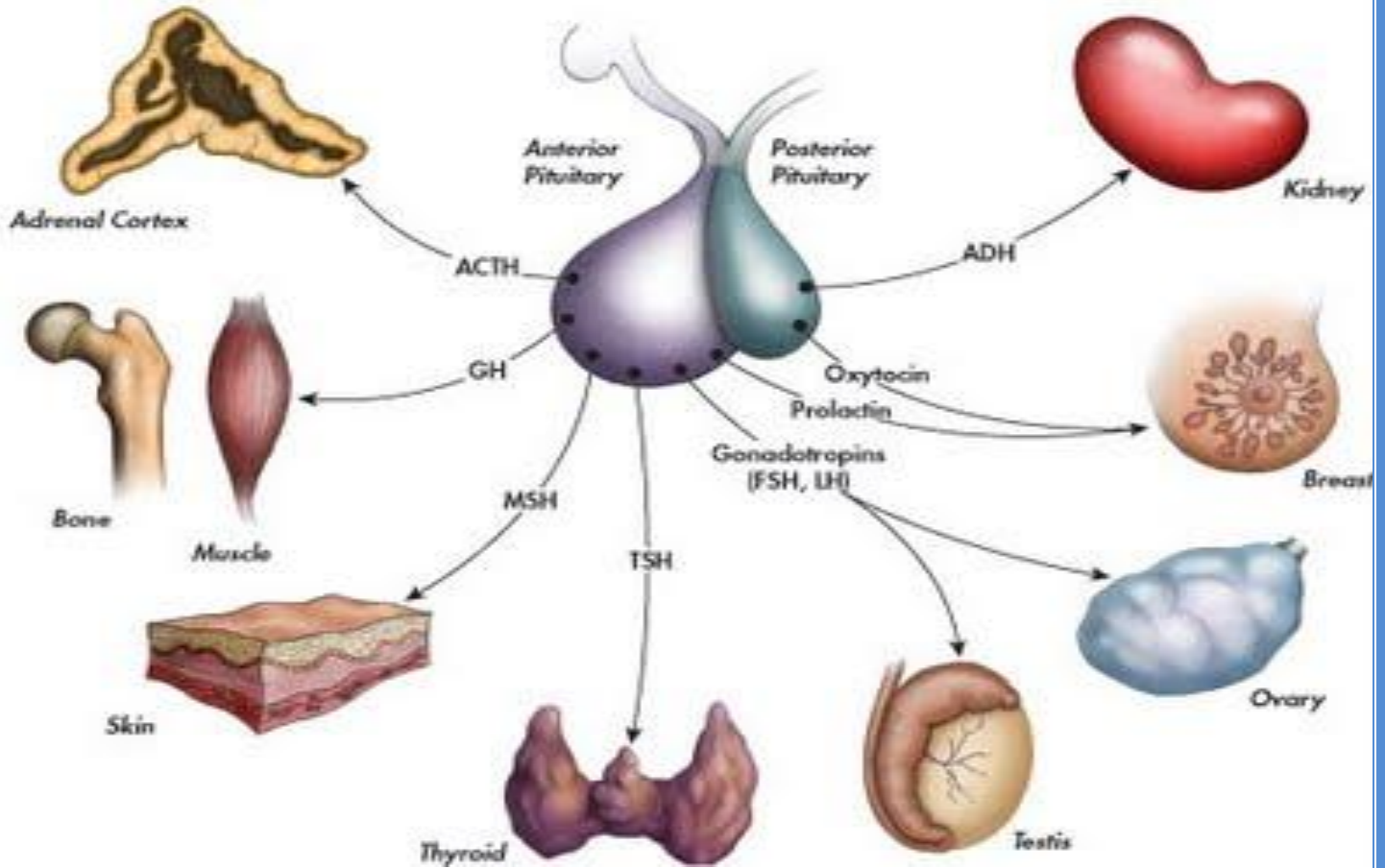


2nd Lecture

Hypothalamic-Pituitary Axis



PHYSIOLOGY TEAM – 430

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Hypothalamic-Pituitary Axis

- **Hypothalamic-Pituitary Axis:**

- Coordinates the functions of the thyroid, adrenal, and reproductive glands and also controls growth, milk production and ejection, and osmoregulation

- **Hypothalamus:**

- It is composed of nerve cells.
- It is connected to the pituitary gland through the infundibulum.
- Controls the pituitary gland secretions by hypothalamic releasing and inhibiting hormone (anterior pituitary), or nervous signals (posterior pituitary)

- **Hypothalamus hormones:**

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

Gland of Origin	Hormones*	Chemical Classification†	Major Actions
Hypothalamus	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

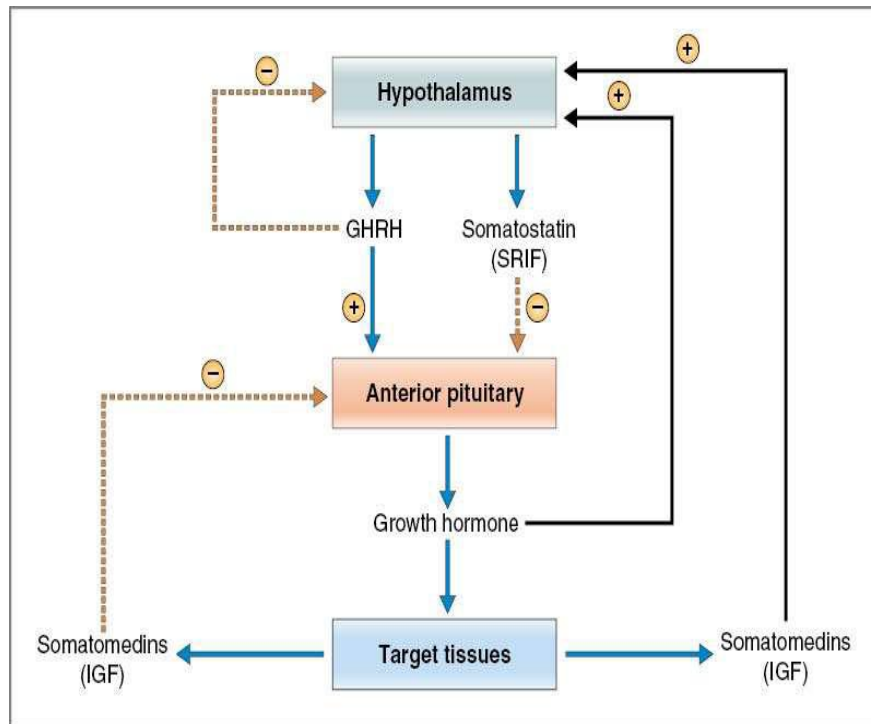
1- GHRH and GHIH/Somatostatin:

✓ Growth hormone releasing hormone (GHRH)

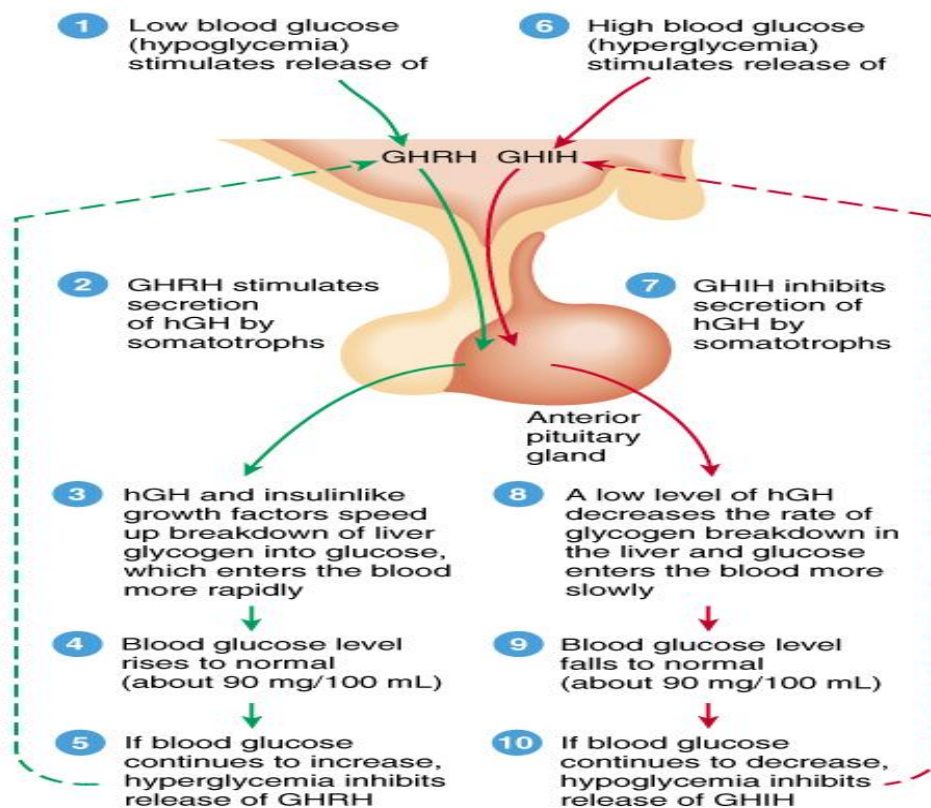
- Stimulates release of growth hormone

✓ Growth hormone inhibiting hormone (GHIH) also called Somatostatin

- Inhibits release of growth hormone



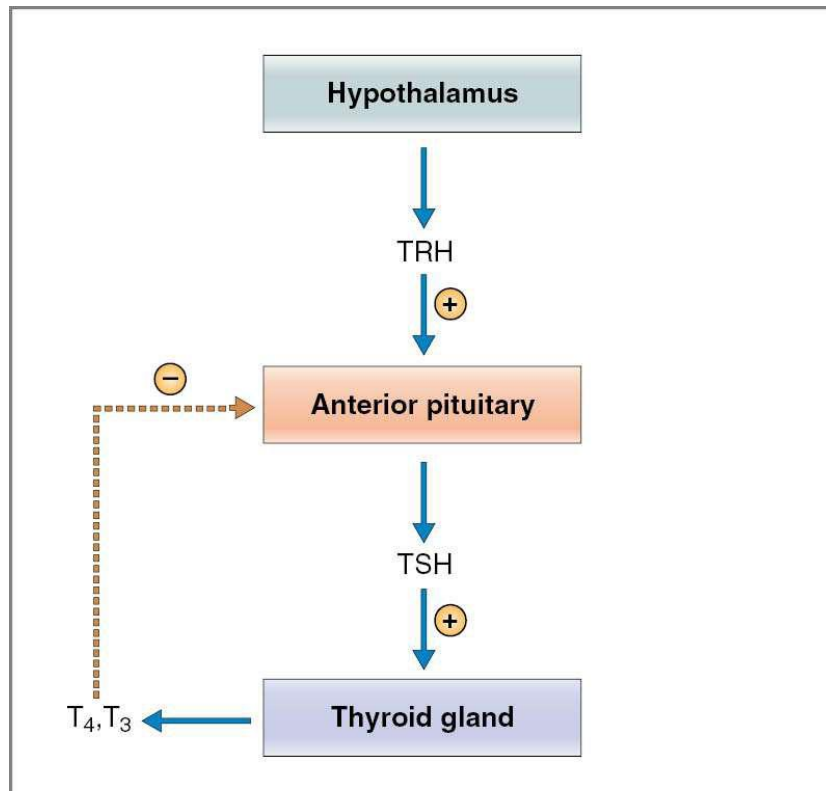
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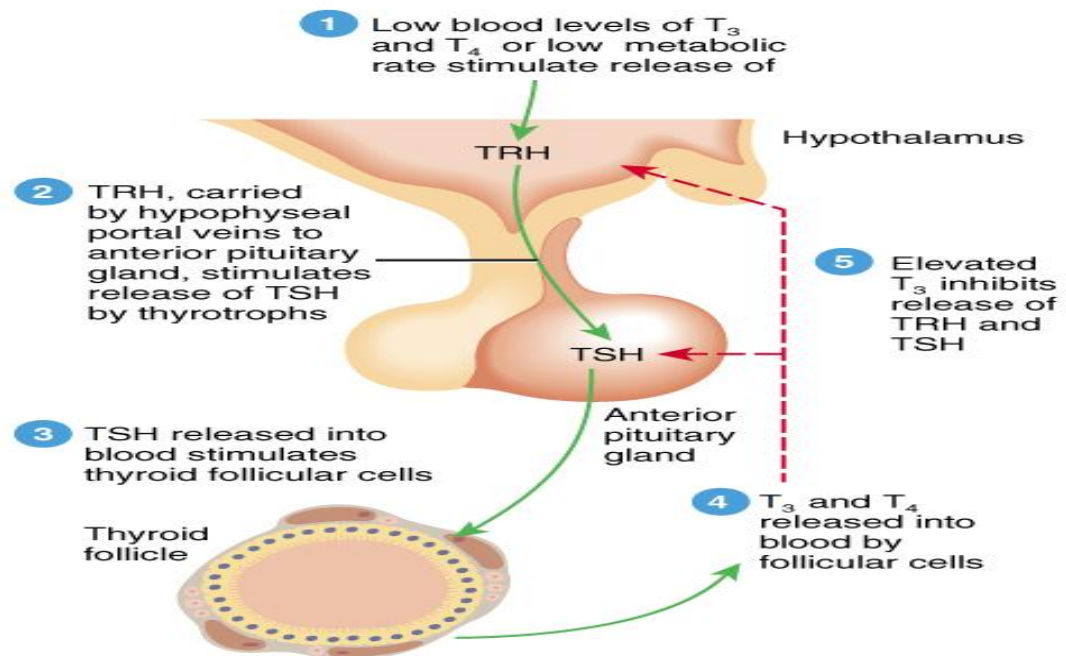
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2- Thyro-tropin releasing hormone:

- Stimulates release of thyroid stimulating hormone (TSH)



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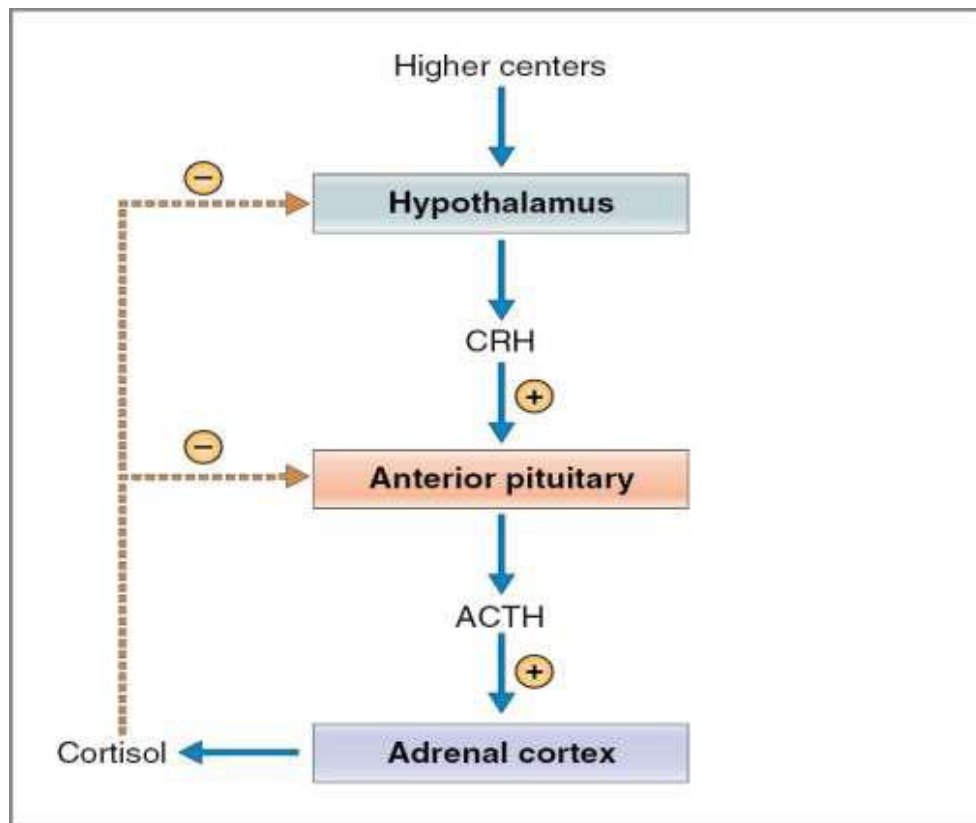
Key:

TRH = Thyrotropin releasing hormone
TSH = Thyroid-stimulating hormone
T₃ = Triiodothyronine
T₄ = Thyroxine (Tetraiodothyronine)

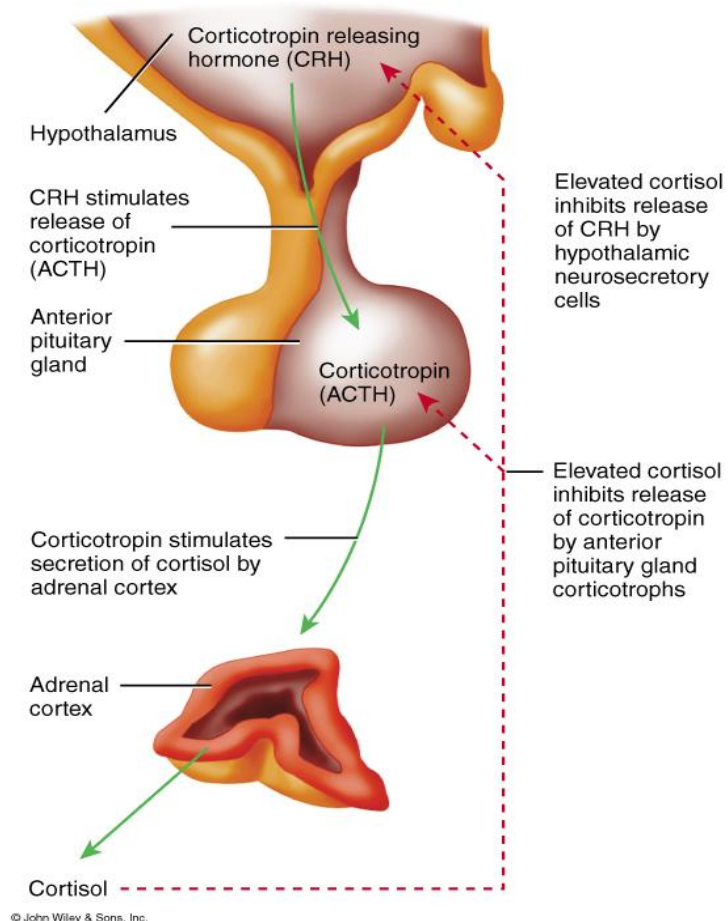
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3- Corticotropin-Releasing hormone:

- Stimulates release of adrenocorticotropin hormone (ACTH)



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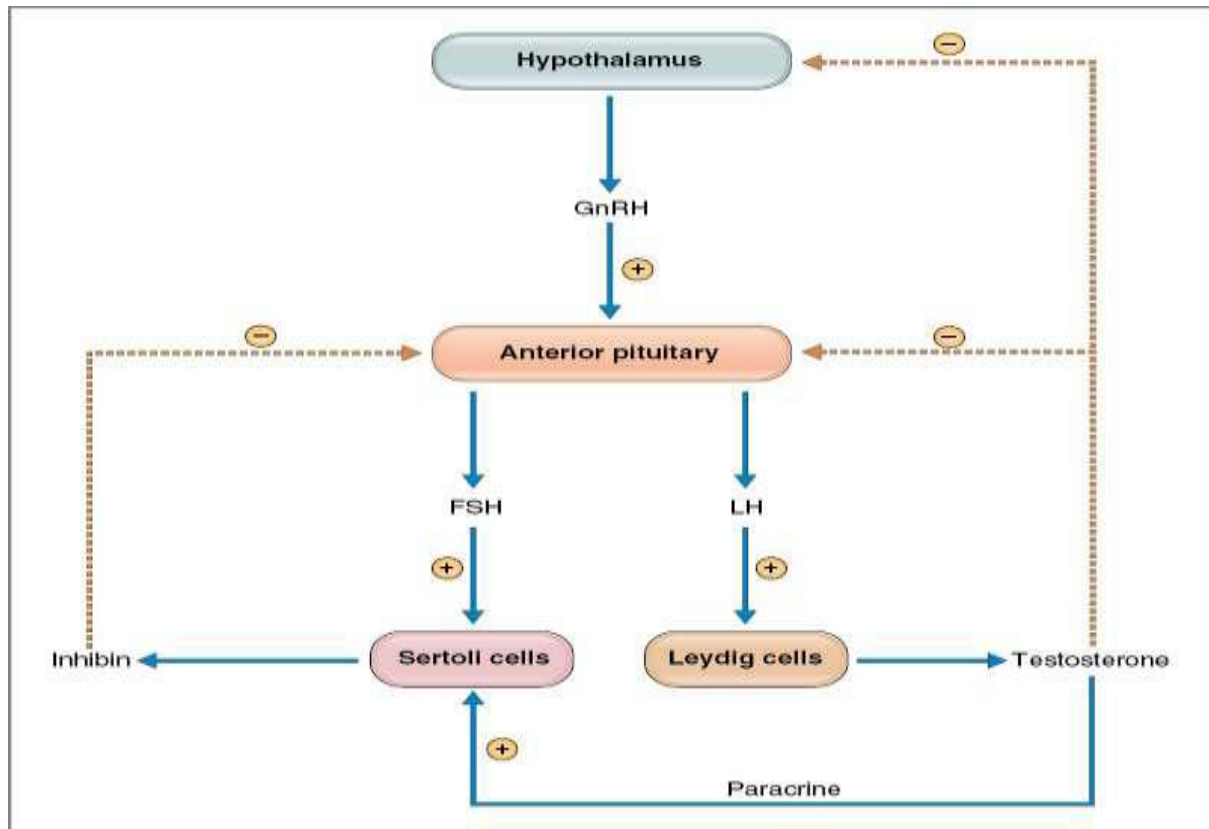


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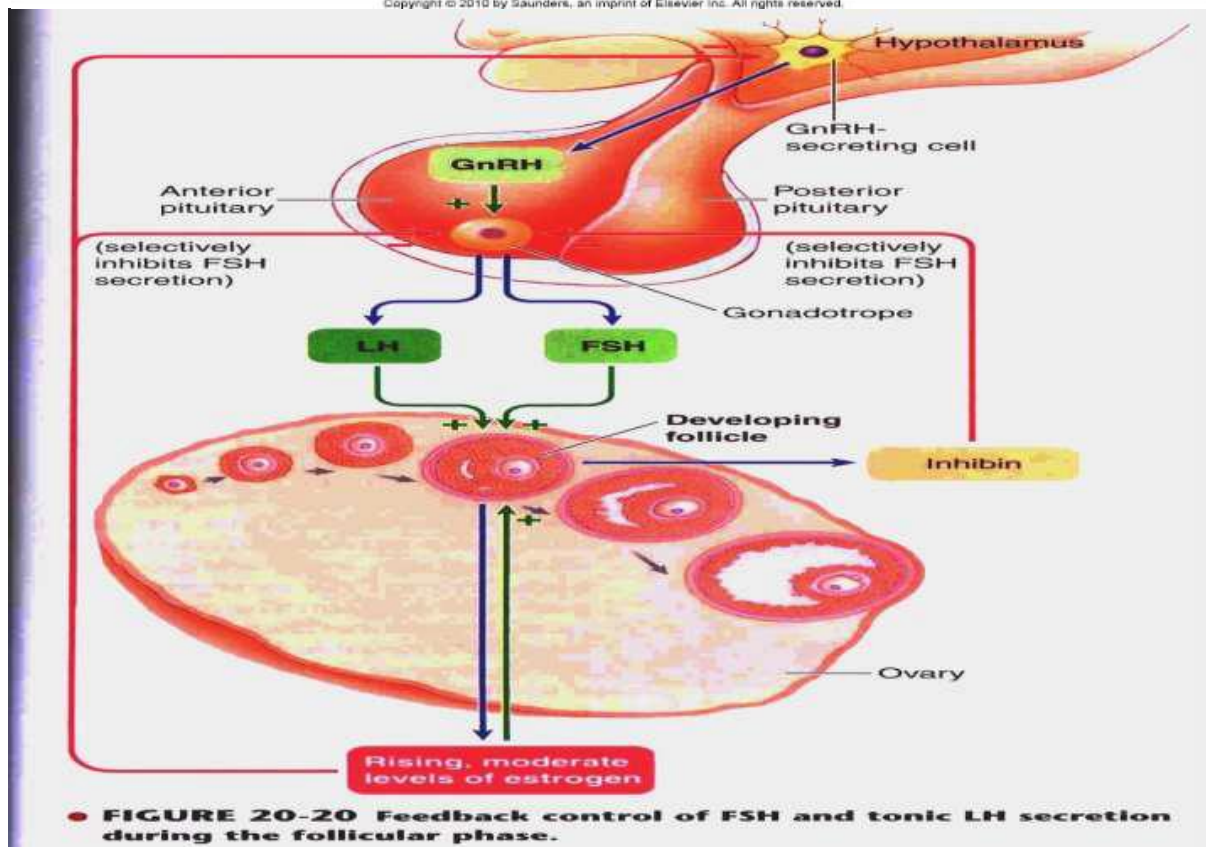
4- Gonadotropin Releasing hormone:

- It causes release of the 2 gonadotropic hormones:

1. Luteinizing (LH)
2. Follicle-stimulating hormone FSH



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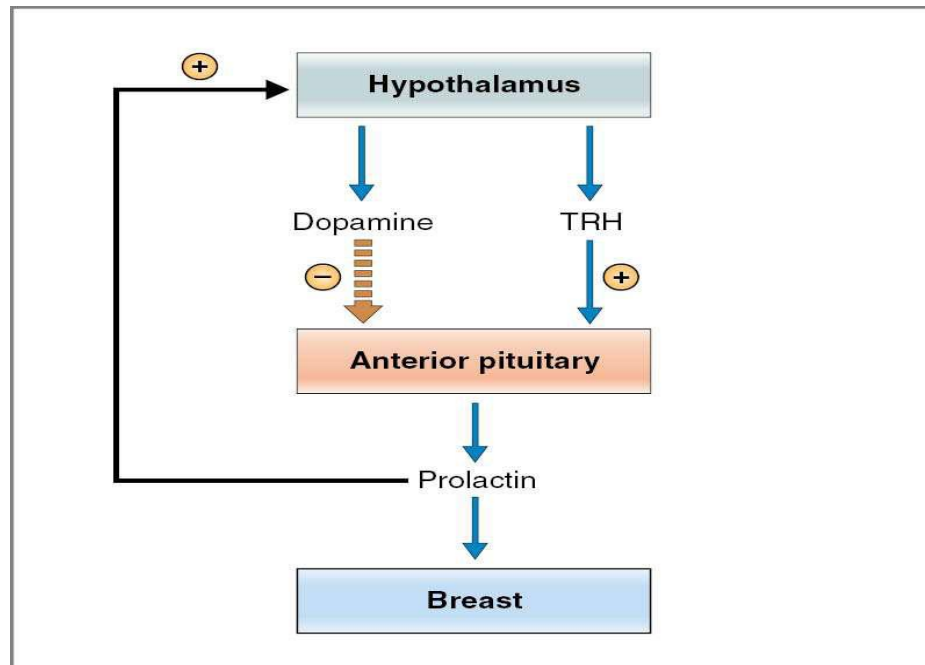


5- Prolactin inhibitory hormone:

- Also known as: Dopamine
- Inhibits prolactin secretion

Note:

In persons who are not pregnant/lactating, prolactin secretion is tonically inhibited by dopamine from Hypothalamus



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- When the mother hears her baby crying, the hypothalamus will inhibit PIH which will cause the release of prolactin

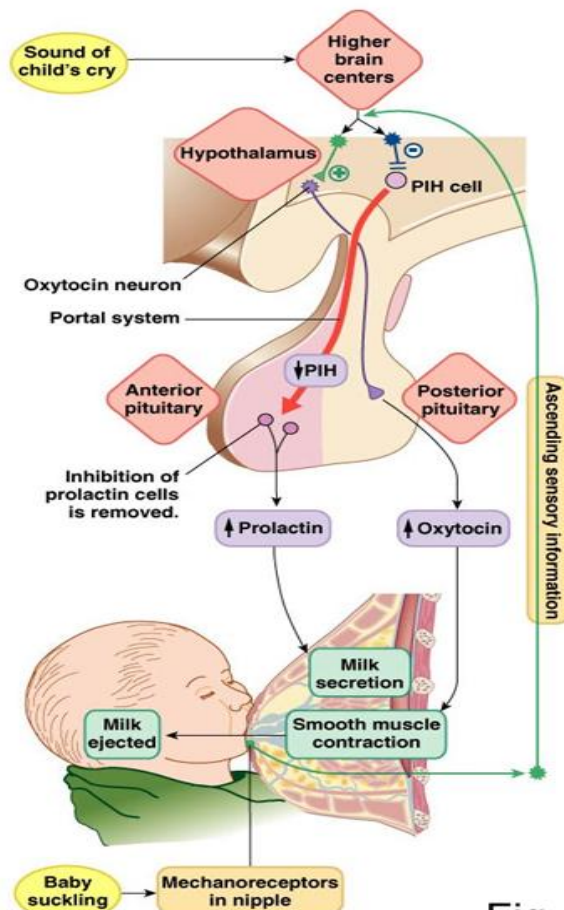


Fig. 26-23

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- Relationship of the Hypothalamus to the anterior pituitary:

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Table 11.6 | Anterior Pituitary Hormones

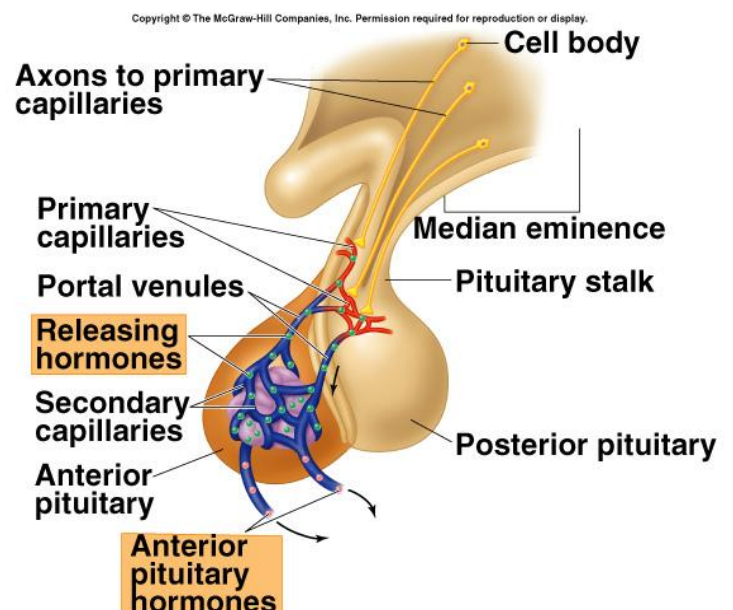
Hormone	Target Tissue	Principal Actions	Regulation of Secretion
ACTH (adrenocorticotrophic hormone)	Adrenal cortex	Stimulates secretion of glucocorticoids	Stimulated by CRH (corticotropin-releasing hormone); inhibited by glucocorticoids
TSH (thyroid-stimulating hormone)	Thyroid gland	Stimulates secretion 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

- The anterior lobe is primarily a collection of endocrine cells.
- The anterior pituitary secretes 6 peptide hormones,
From 5 different cell types:

1. Somatotrops: 40% GH
2. Thyrotrop: TSH
3. Corticotrops: 20% ACTH
4. Lactotrops: PRL
5. Gonadotrops: LH & FSH

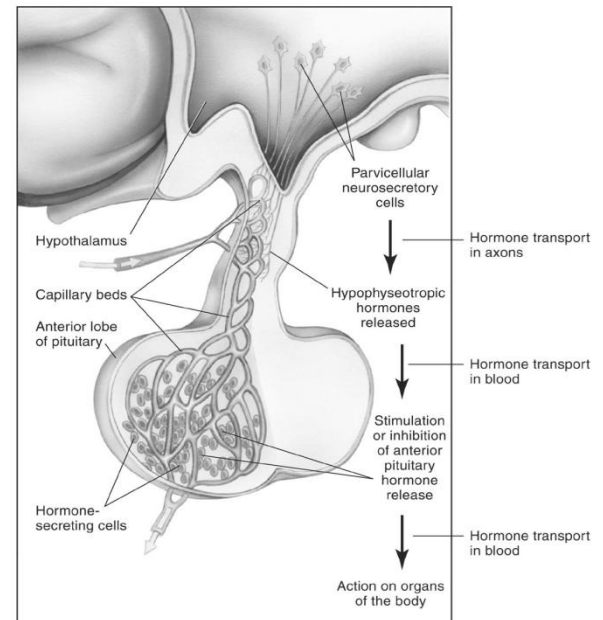
- Hypothalamic-Hypophyseal portal vessels:**

- The hypothalamus and anterior pituitary are linked directly by hypothalamic-hypophyseal portal vessels



- **Control of anterior pituitary by hypothalamus:**

- 1) Special neurons: Parvicellular neurosecretory cells, hormones are synthesized in the hypothalamus and regulate secretions of anterior pituitary
- 2) Neurons send their nerve fibers (short axons) to the median eminence (extension of hypothalamic tissue into the pituitary stalk)
- 3) Hormones are secreted to the tissue fluids "neuroendocrine", absorbed into the hypothalamic hypophyseal portal system and transported to the sinuses of the anterior pituitary to regulate the secretion of pituitary hormones

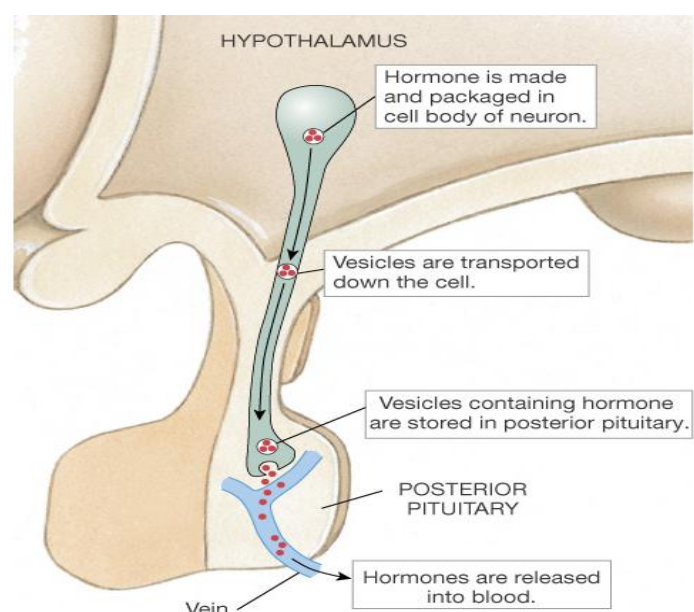


- **Relationship of the Hypothalamus to the posterior pituitary:**

- The posterior lobe of pituitary is collection of nerve axons and supporting cells.
- It secretes 2 peptide hormones: ADH and oxytocin
- The connections between the hypothalamus and the posterior lobe of pituitary gland are neural (hypothalamo-hypophyseal tract)

- **Control of posterior pituitary by hypothalamus:**

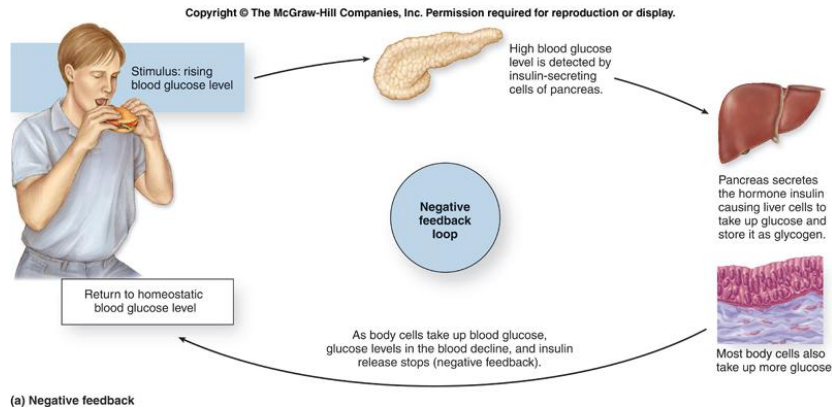
- Hormones (Vasopressin and oxytocin) are synthesized in magnocellular neurons in paraventricular (mainly oxytocin) and supraoptic (mainly ADH) nuclei of the hypothalamus → The hormones are transported down the (long) axons, and are stored in the nerve terminals in the posterior pituitary → when stimulated; they're secreted directly into capillaries in the posterior lobe → hormones then enter the systemic circulation to be delivered to their target tissues



- **Feedback mechanisms:**

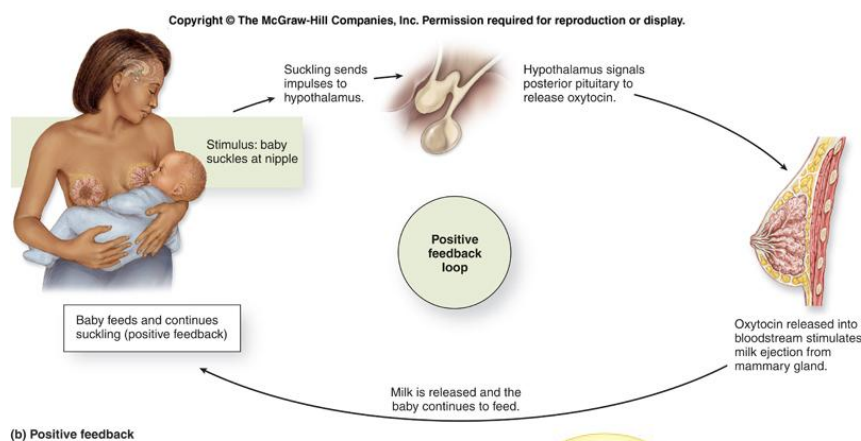
- **Negative feedback:**

Release of hormone A stimulates the release of hormone B → hormone B inhibits the release of hormone A



- **Positive feedback:**

Release of hormone A stimulates the release of hormone B → hormone B stimulates further release of hormone A



- **Negative feedback loop reflexes:**

- **Long-loop feedback** → means that the hormone feeds back all the way to the hypothalamic-pituitary axis.
- **Short-loop feedback** → means that the anterior hormone feeds back on the hypothalamus to inhibit secretion of hypothalamic-releasing hormone

