

Hypothalamus and Pituitary

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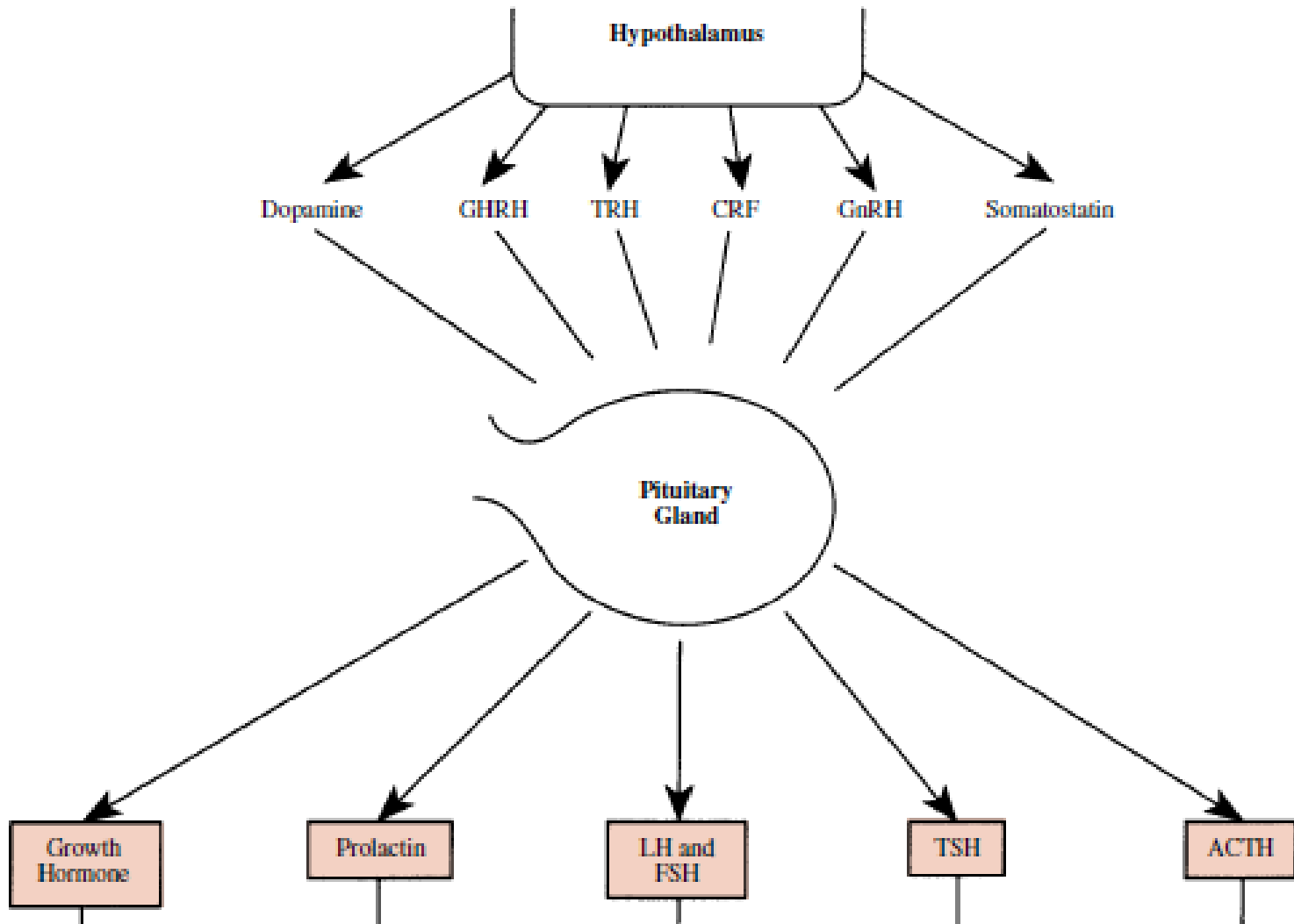
- The hypothalamus-pituitary unit is the most dominant portion of the entire endocrine system.
- The output of the hypothalamus-pituitary unit regulates the function of the thyroid, adrenal and reproductive glands and also controls somatic growth, lactation, milk secretion and water metabolism.

- Pituitary function depends on the hypothalamus and the anatomical organization of the hypothalamus-pituitary unit reflects this relationship.

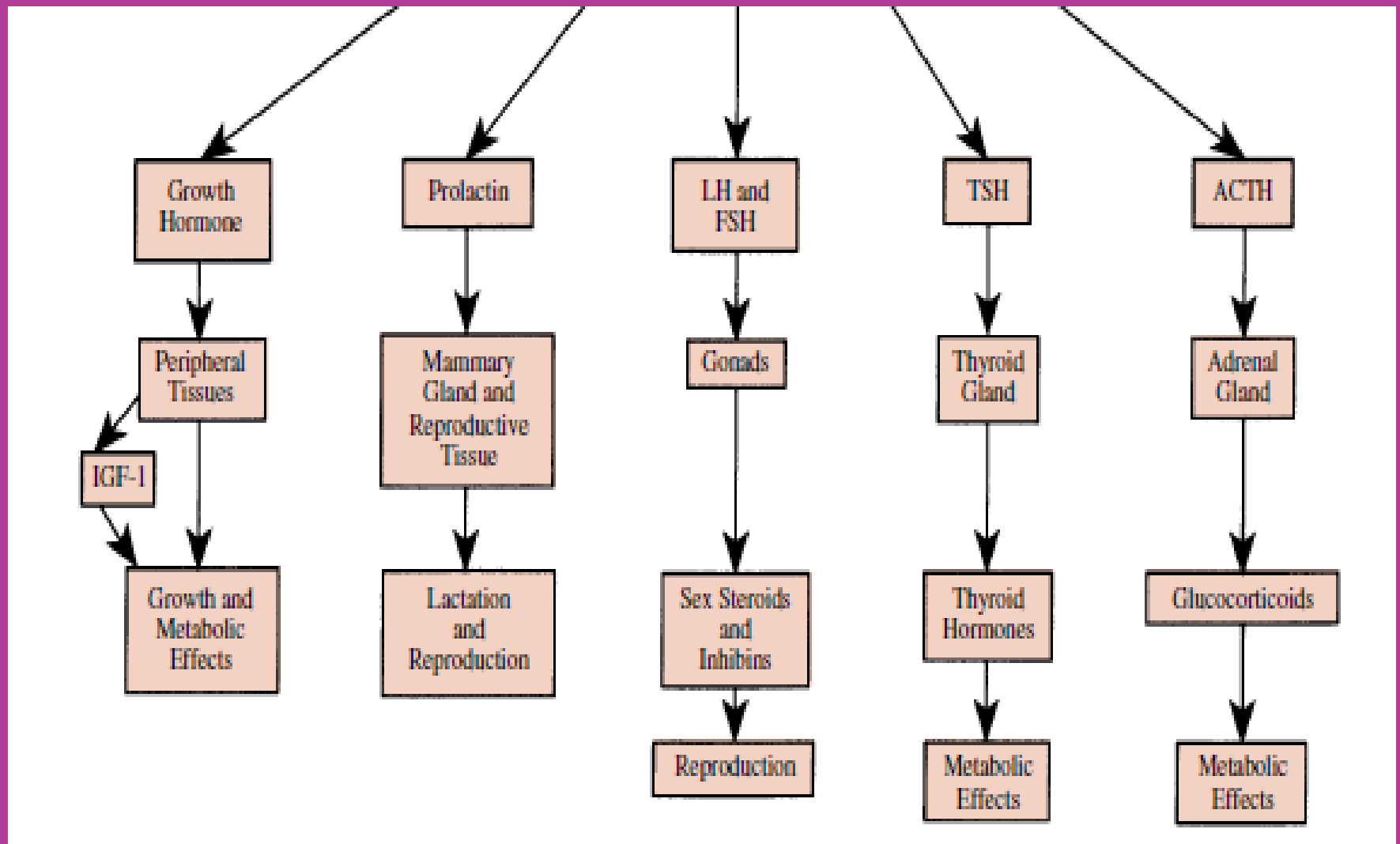
- The pituitary gland lies in a pocket of bone at the base of the brain, just below the hypothalamus to which it is connected by a stalk containing nerve fibers and blood vessels. The pituitary is composed to two lobes--**anterior** and **posterior**

ANTERIOR PITUITARY HORMONES

Six major hormones are secreted by the adenohypophysis, or anterior pituitary gland



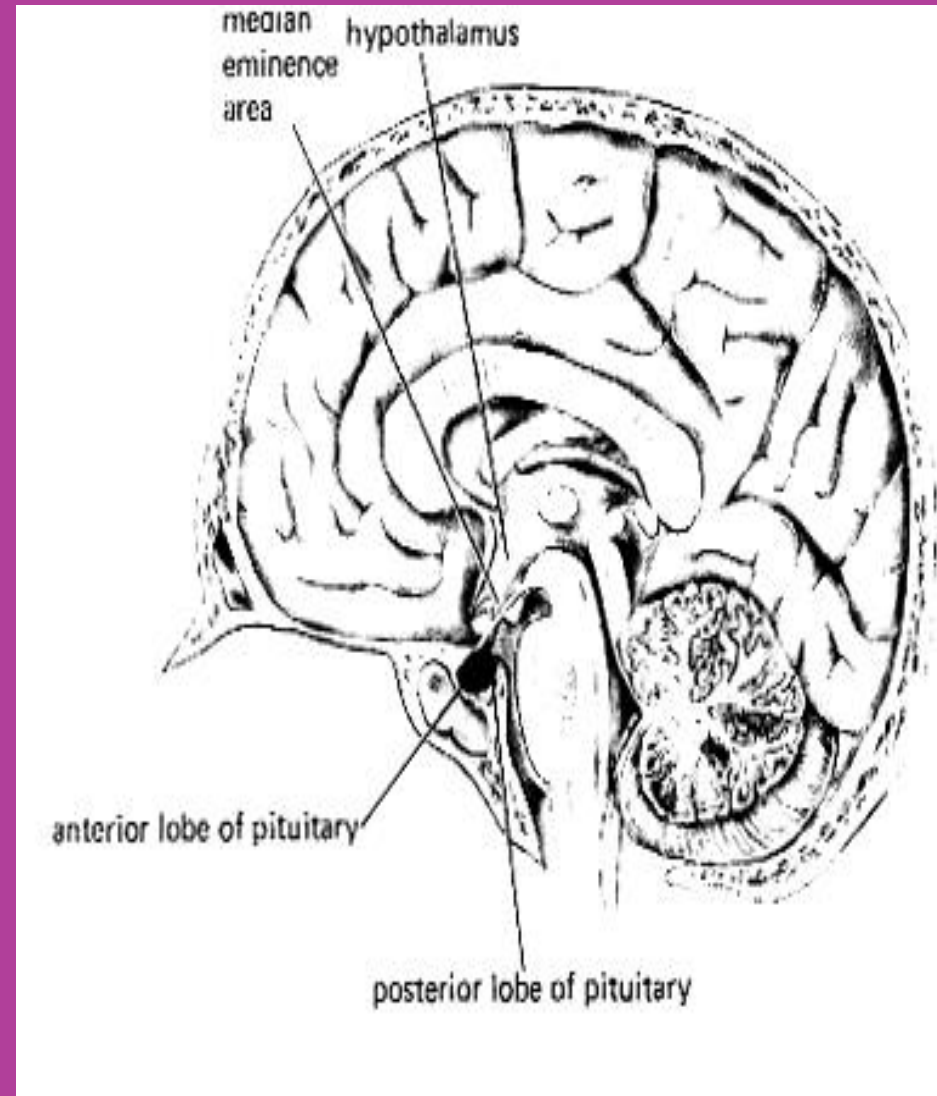
Hormones of the hypothalamus and the anterior pituitary gland



TRH, thyrotropin releasing hormone; CRF, corticotropin releasing hormone;
GnRH, gonadotropin releasing hormone; LH, luteinizing hormone; FSH, follicle-stimulating hormone;
TSH, thyroid-stimulating hormone; ACTH, adrenocorticotrophic hormone; IGF-1, insulinlike growth factor 1.

Anterior pituitary: adenohypophysis

- **Anterior pituitary:** connected to the hypothalamus by hypothalamoanterior pituitary portal vessels.
- The anterior pituitary produces six peptide hormones:
 - prolactin, growth hormone (GH),
 - thyroid stimulating hormone (TSH),
 - adrenocorticotrophic hormone (ACTH),
 - follicle-stimulating hormone (FSH),
 - luteinizing hormone (LH).



Posterior Pituitary: neurohypophysis

- **Posterior pituitary:** an outgrowth of the hypothalamus composed of neural tissue.
- Hypothalamic neurons pass through the neural stalk and end in the posterior pituitary.
- The upper portion of the neural stalk extends into the hypothalamus and is called the **median eminence**.

Hypothalamic releasing hormones

Travel to specific cells in anterior pituitary to stimulate synthesis and secretion of trophic hormones

Hypothalamic releasing hormone	Effect on pituitary
Corticotropin releasing hormone (CRH)	Stimulates ACTH secretion
Thyrotropin releasing hormone (TRH)	Stimulates TSH and Prolactin secretion
Growth hormone releasing hormone (GHRH)	Stimulates GH secretion
Somatostatin	Inhibits GH (and other hormone) secretion
Gonadotropin releasing hormone (GnRH)	Stimulates LH and FSH secretion
Prolactin releasing hormone (PRH)	Stimulates PRL secretion
Prolactin inhibiting hormone (dopamine)	Inhibits PRL secretion

ANTERIOR PITUITARY HORMONES

Anterior pituitary hormones

ANTERIOR PITUITARY GLAND CELL TYPE	STIMULATORY HYPOTHALAMIC FACTORS	INHIBITORY HYPOTHALAMIC FACTORS	PITUITARY HORMONES RELEASED	MAJOR TARGET ORGAN	TARGET GLAND HORMONES
Somatotroph	GHRH, Ghrelin	Somatostatin	GH	Liver	Insulin-like growth factors
Lactotroph	TRH	Dopamine, Somatostatin	Prolactin	Mammary gland	None
Gonadotroph	GnRH	None known	LH and FSH	Gonads	Estrogen, progesterone, and testosterone
Thyrotroph	TRH	Somatostatin	TSH	Thyroid gland	Thyroxine and triiodothyronine
Corticotroph	CRH	None known	ACTH	Adrenal cortex	Cortisol, adrenal androgens

Growth Hormone

- Growth hormone, or somatotropin, is a protein that stimulates linear body growth in children and regulates cellular metabolism in both adults and children
- stimulates lipolysis, enhances production of free fatty acids, elevates blood glucose
- Enhance production of an insulinlike growth factor (IGF-1)
- Growth hormone is released during sleep, with maximum release occurring an hour after the onset of sleep.

Prolactin

- In women, prolactin acts with other hormones on the mammary gland during pregnancy to develop lactation and after birth to maintain it.
- Hyperprolactinemia causes impotence in men and amenorrhea and infertility in women
- Prolactin serum levels increase during pregnancy and breast-feeding, at least immediately after the birth.
- Increases markedly during stress

- There is no known therapeutic use for prolactin, but serum levels are measured to diagnose hyperprolactinemia

- Approximately one-third of women who need treatment for infertility have high serum prolactin levels.

- Hyperprolactinemia has been traditionally treated by the dopaminergic agonist bromocriptine (*Parodel*)

Lactotrophs

- Site of production of prolactin
- Lactogenesis (milk synthesis) requires prolactin
- Dopamine inhibits prolactin
- Prolactin releasing hormone is TRH
 - Oxytocin also stimulates prolactin release
 - Estradiol enhances prolactin synthesis

ACTH: adrenocorticotrophic hormone: synthesis and regulation of secretion

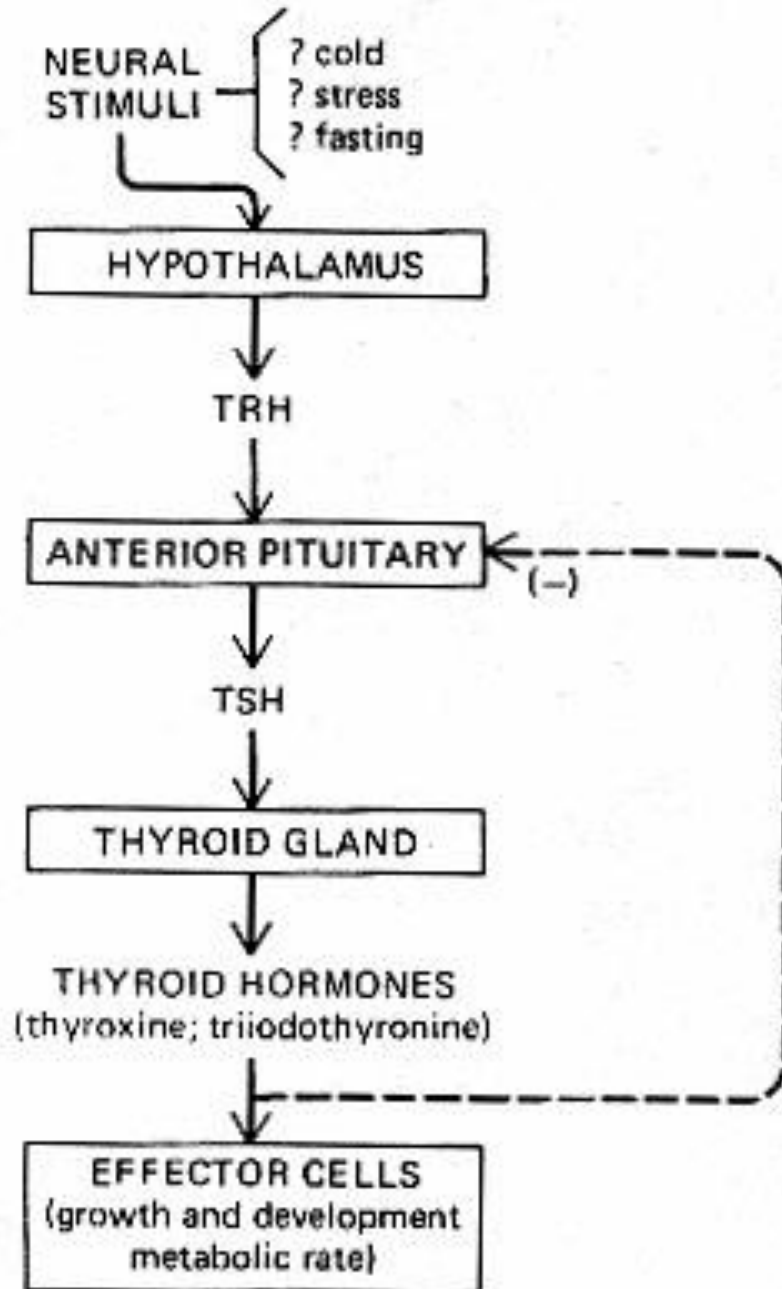
- Produced in corticotrophs
- ACTH is produced in the anterior pituitary by proteolytic processing of Prepro-opiomelanocortin (POMC).
- Other neuropeptide products include β and γ lipotropin, β -endorphin, and α -melanocyte-stimulating hormone (α -MSH).
- ACTH is a key regulator of the stress response

Thyroid-Stimulating Hormone

- TSH, or thyrotropin, is a glycosylated protein of two subunits, α and β .
- TSH stimulates the thyroid gland to produce thyroid hormones.
- Deficiencies are treated by giving thyroxine itself rather than TSH,
- but TSH is available for diagnostic purposes to differentiate between pituitary and thyroid gland failure as causes of hypothyroidism

Thyrotrophs

- Site of TSH synthesis
- Pattern of secretion is relatively steady
- TSH secretion stimulated by TRH
- Feedback control by T3 (thyroid hormone)



Feedback
control of
thyroid
function

ACTH

- Adrenocorticotrophic hormone (ACTH), or corticotropin
- ACTH is made up of 39 amino acids
 - Regulates adrenal cortex and synthesis of adrenocorticosteroids
 - Overproduction of ACTH may accompany increased pigmentation due to α -MSH.
- ACTH stimulates

Feedback regulation of hypothalamus/pituitary

- A prominent feature of each of the hormonal sequences initiated by the hypothalamic releasing hormones is negative feedback exerted upon the hypothalamic-pituitary system by the hormones whose production are stimulated in the sequence.

