

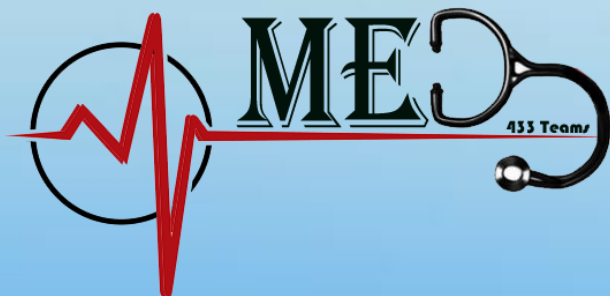


Physiology team

2 Physiology of Hypothalamic – Pituitary axis



**Sources:
Female slides .
BRS Physiology 227-
232.**

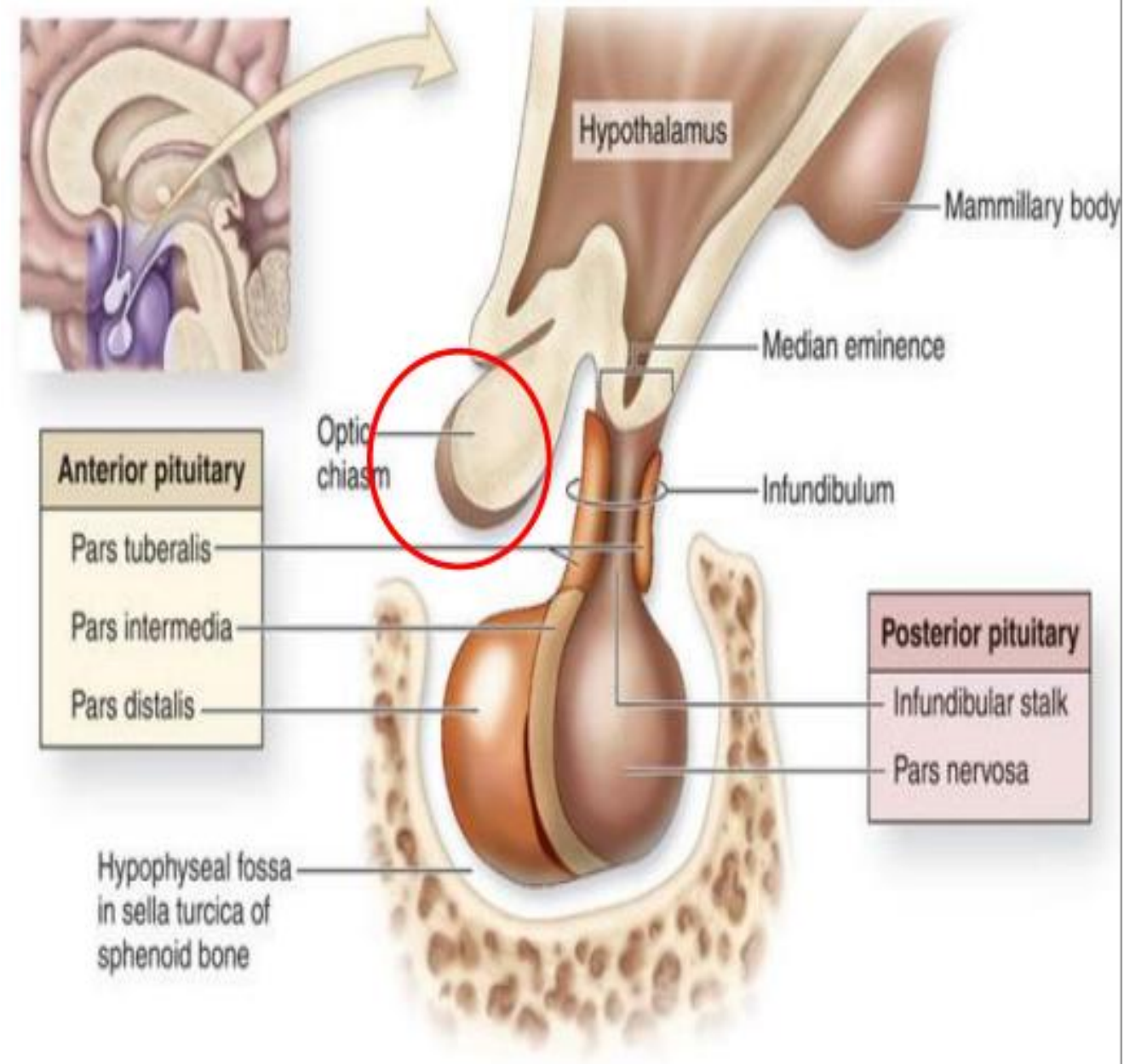


Objectives

- 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 the hypothalamus

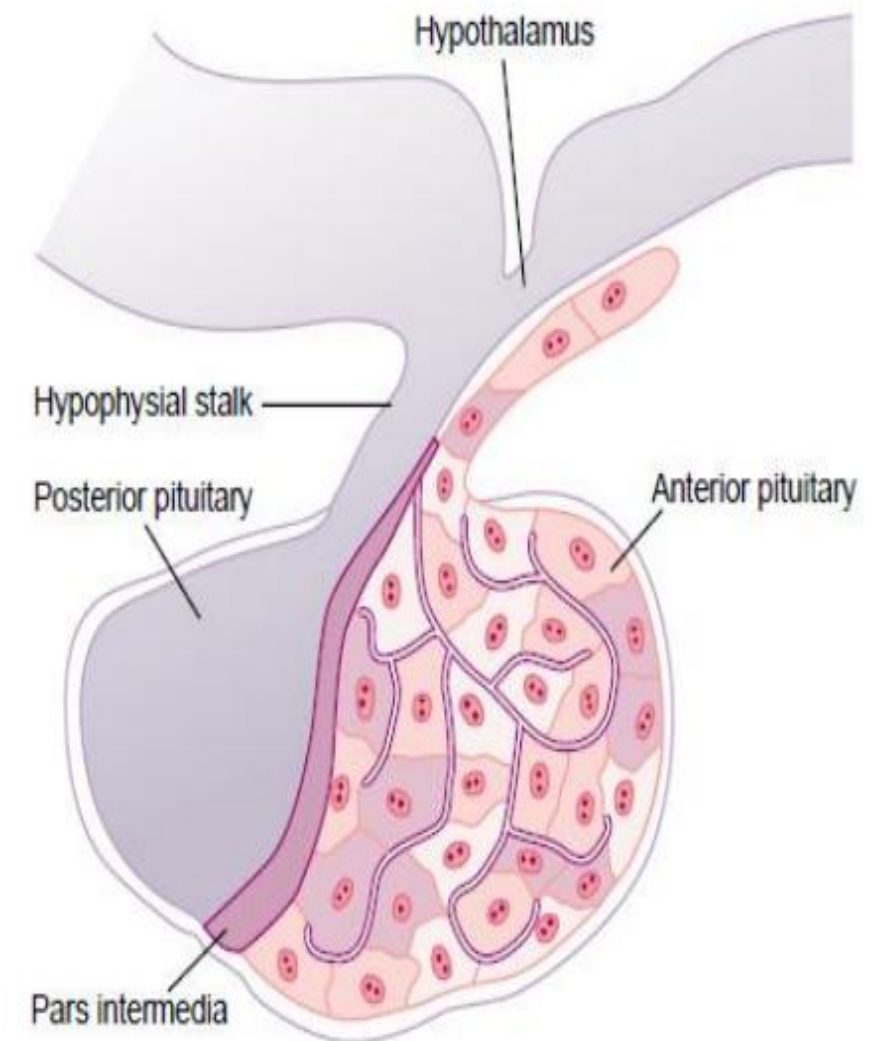
- The pituitary gland (**the hypophysis**), is a small gland about 1 cm in diameter and 0.5 to 1 g in weight
- It lies in the sella turcica, a bony cavity at the base of the skull
- It is connected to the **hypothalamus** by the pituitary stalk which is bundle of nerve fibres originated from **hypthalamic nucleus**.



Structure of pituitary gland

- 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.

* Its function is to produce Melanocyte Stimulating Hormone (**MSH**), which cause release of melanin pigment in skin melanocyte.



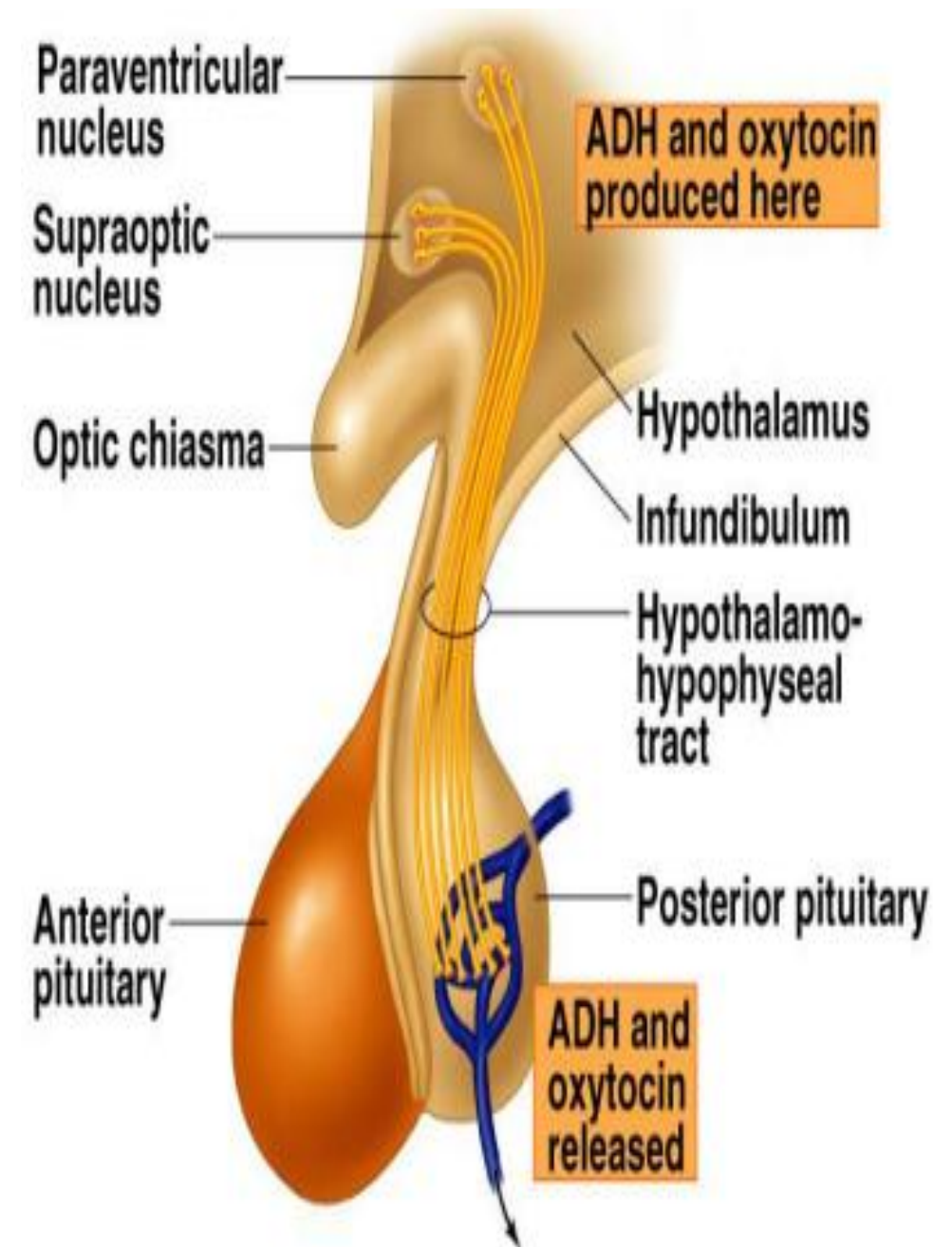
	Adenohypophysis	Neurohypophysis
Embryonic origin	Rathke's pouch*	neural tissue outgrowth from hypothalamus
Nature of the cells	Epithelioid nature	Neural nature**
Function	Secretion of Hormones	Storage of Hormones
Secretion is Controlled by hypothalamus by	Hormonal signals	Nervous signals
Connection with Hypothalamus	Vascular connection (hypothalamic-hypophysial portal system)	Neural connection (hypothalamic-hypophysial tract)

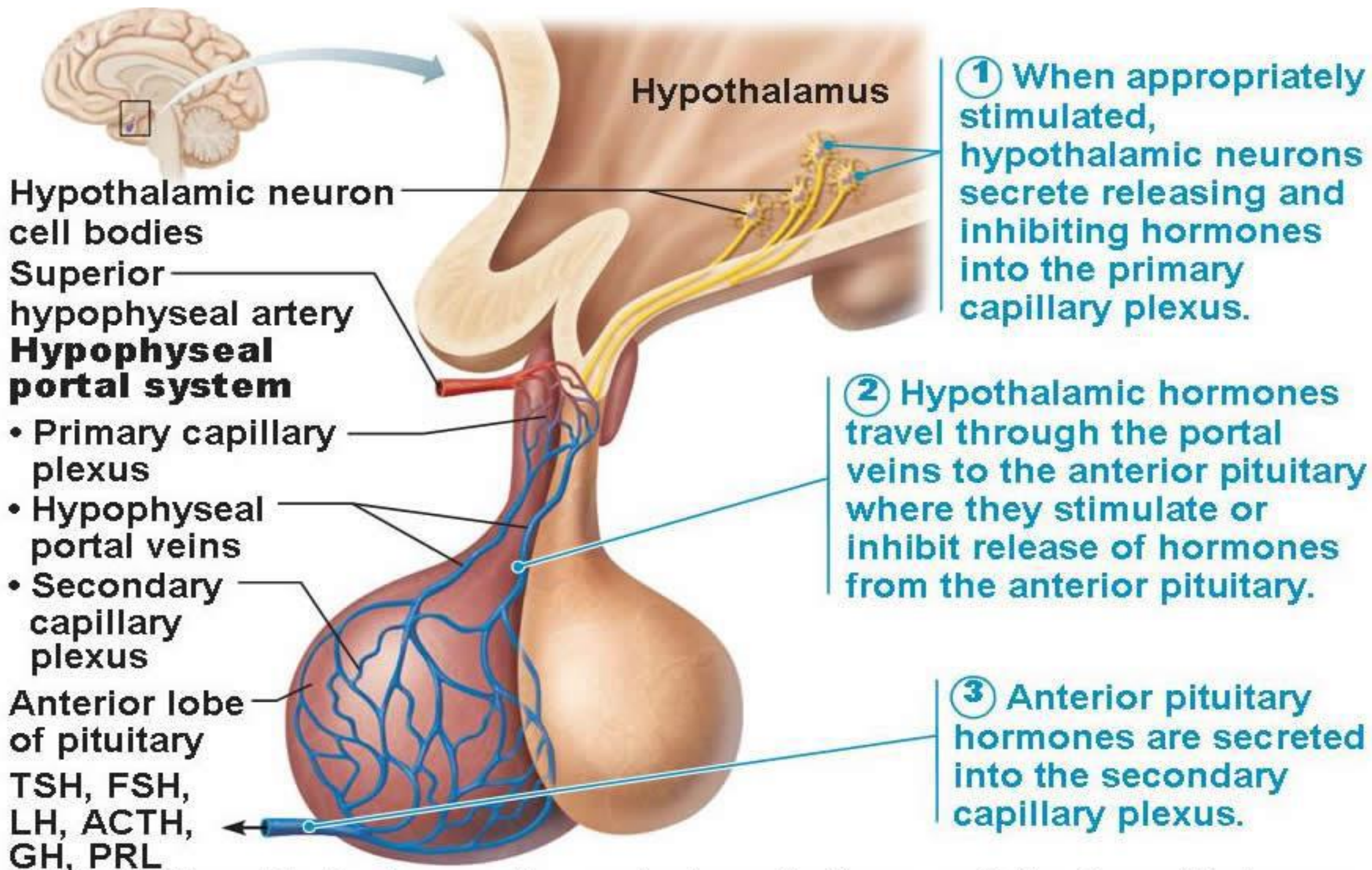
*invagination of the pharyngeal epithelium.

**This explains the presence of large numbers of glial-type cells in this gland

Hypothalamic control of Anterior Pituitary

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

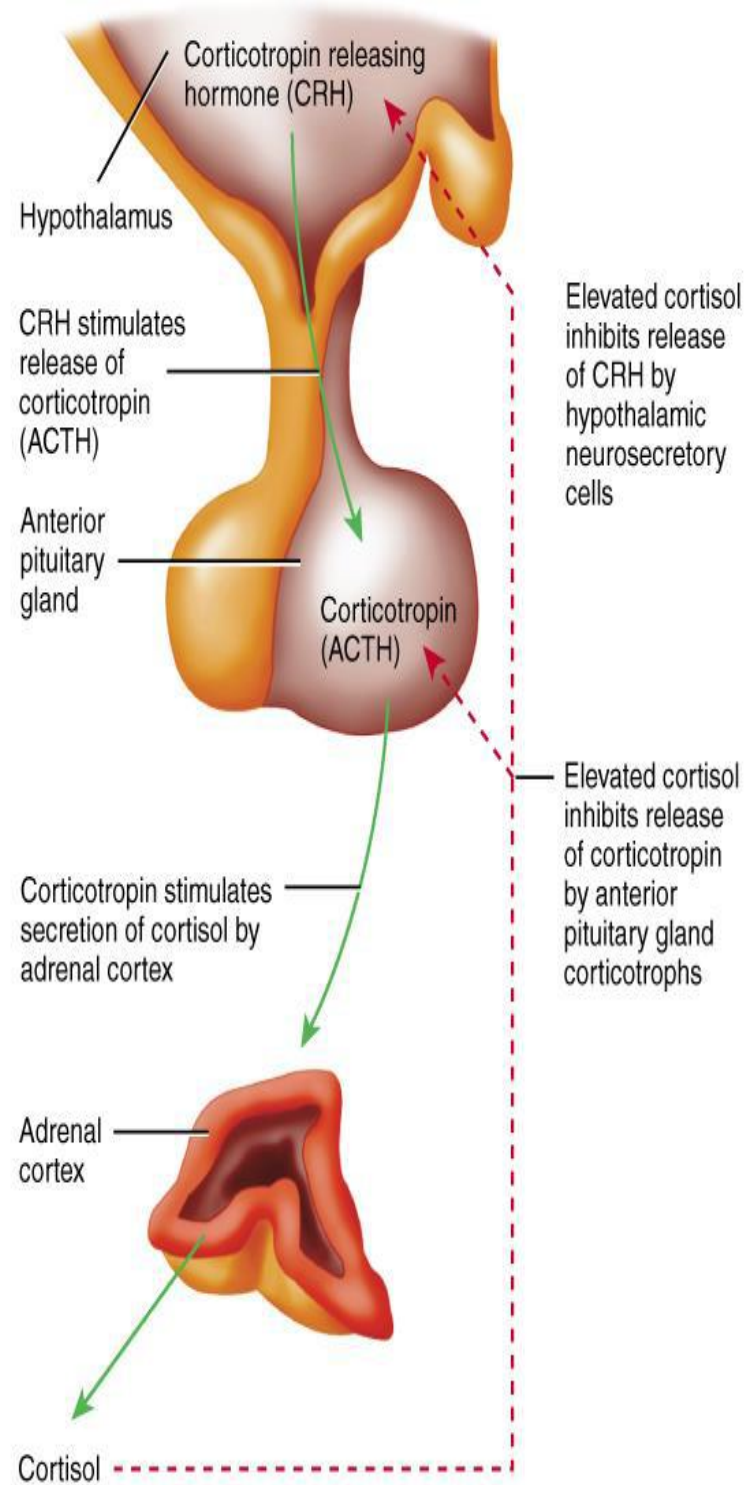
Hormone	Released by
TSH (Thyrotropin)	Thyrotropes cells
ACTH (Corticotropin)	Corticotropes cells
GH (Somatotropin)	Somatotropes cells
LH & FSH (Gonadotropin)	Gonadotropes cells
Prolactin (PRL)	Lactotropes cels

Hypothalamic Hormones :

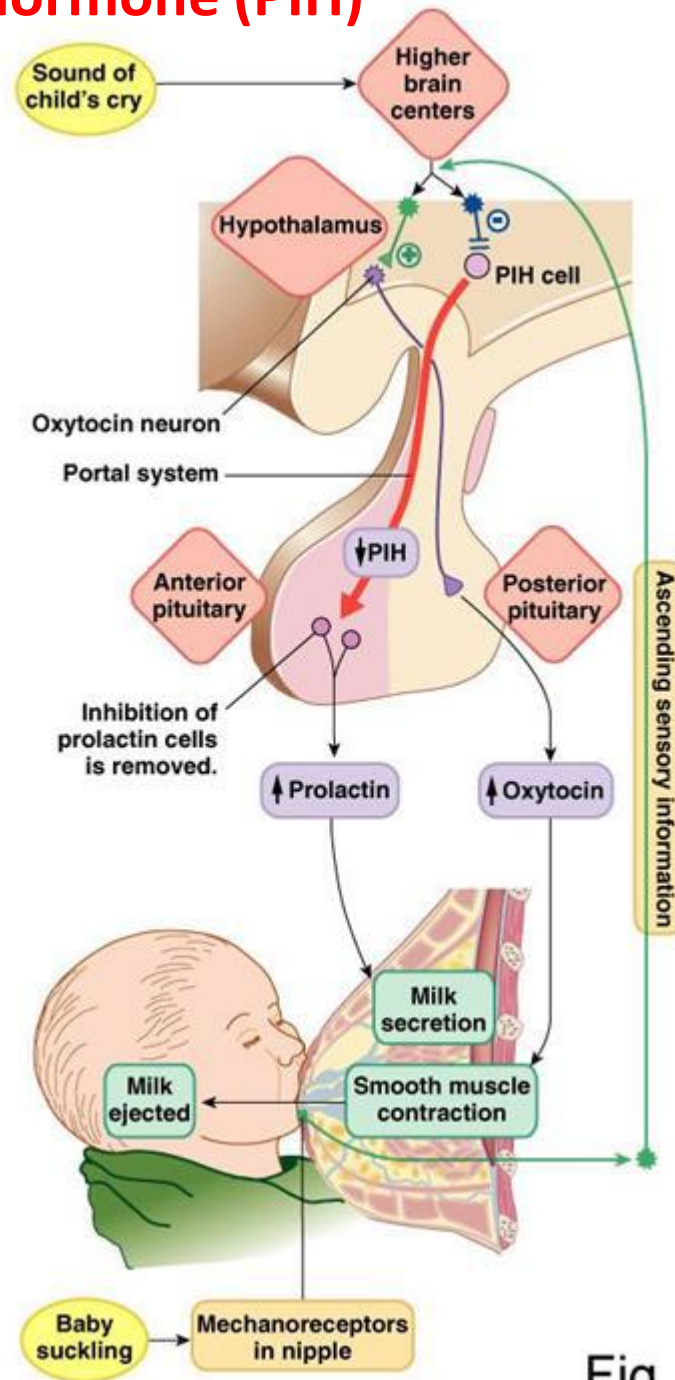
Releasing Hormones	
TRH Thyrotropin-releasing hormone	<i>Stimulates</i> release of thyroid stimulating hormone (TSH).
CRH Corticotropin-releasing hormone	<i>Stimulates</i> release of adrenocorticotropin hormone (ACTH).
GHRH Growth hormone releasing hormone	<i>Stimulates</i> release of growth hormone (GH).
GnRH Gonadotropin releasing hormone	<i>Stimulates</i> release of the 2 gonadotropic hormones: <ul style="list-style-type: none"> - Luteinizing (LH). - Follicle-stimulating hormone (FSH).

Inhibitory Hormones	
GHIH Growth hormone inhibiting hormone	also called Somatostatin . <i>Inhibits</i> release of GH .
PIH Prolactin inhibitory hormone	also known as Dopamine . <i>Inhibits</i> prolactin secretion

Corticotropin-releasing hormone (CRH)



Prolactininhibitory hormone (PIH)



Thyrotropin-releasing hormone (TRH)

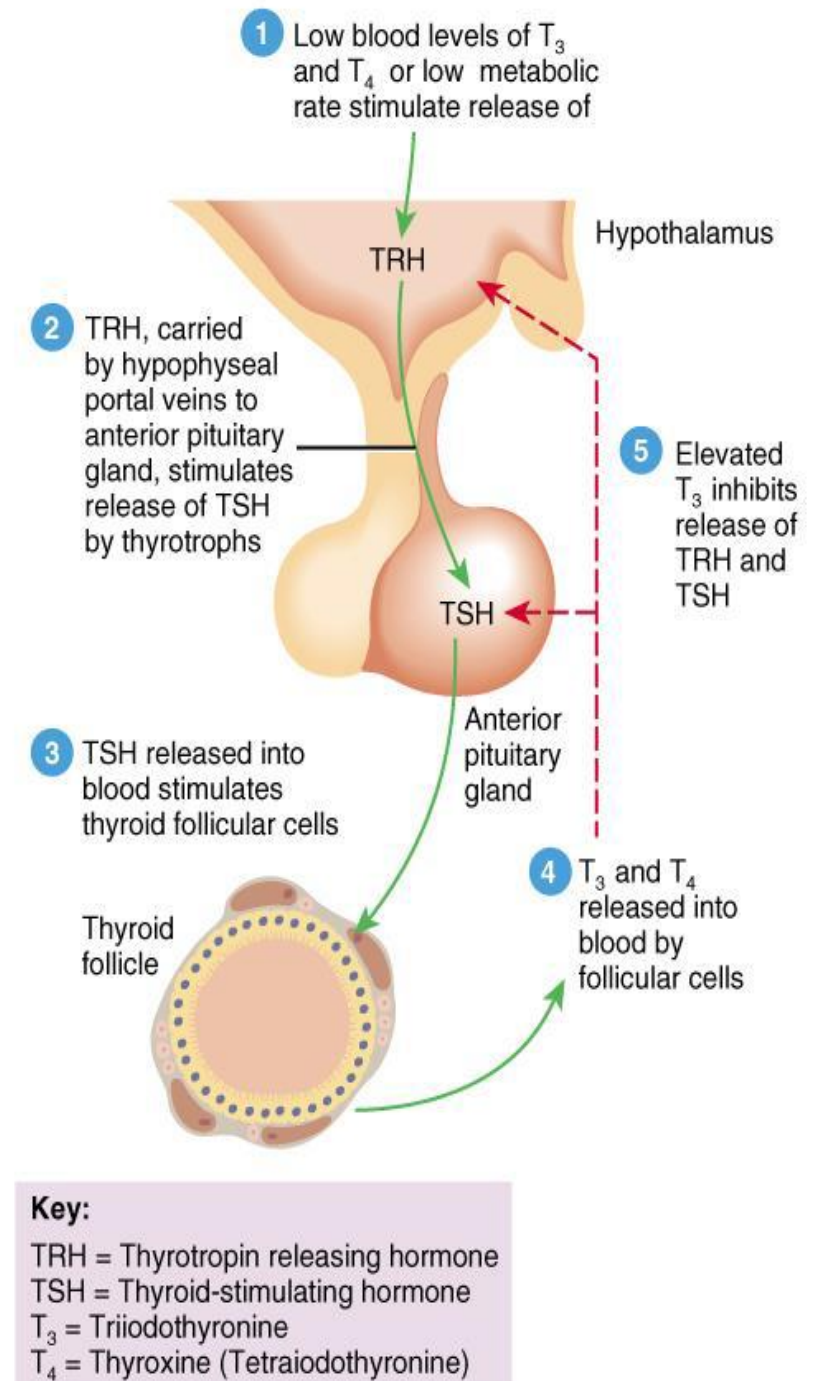
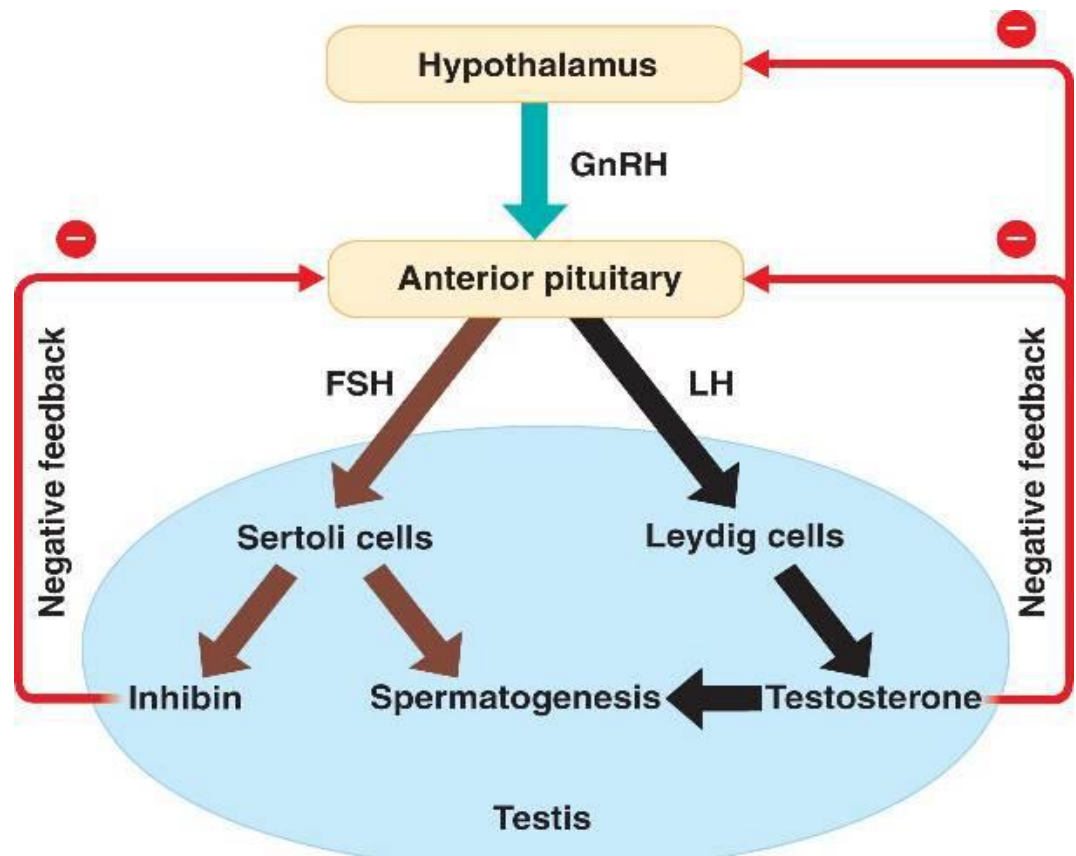
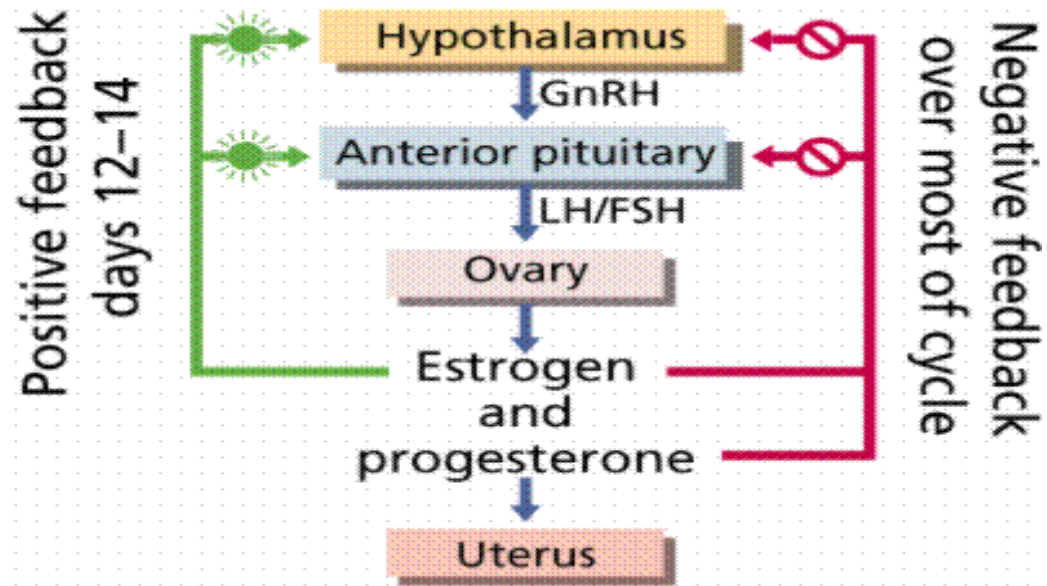
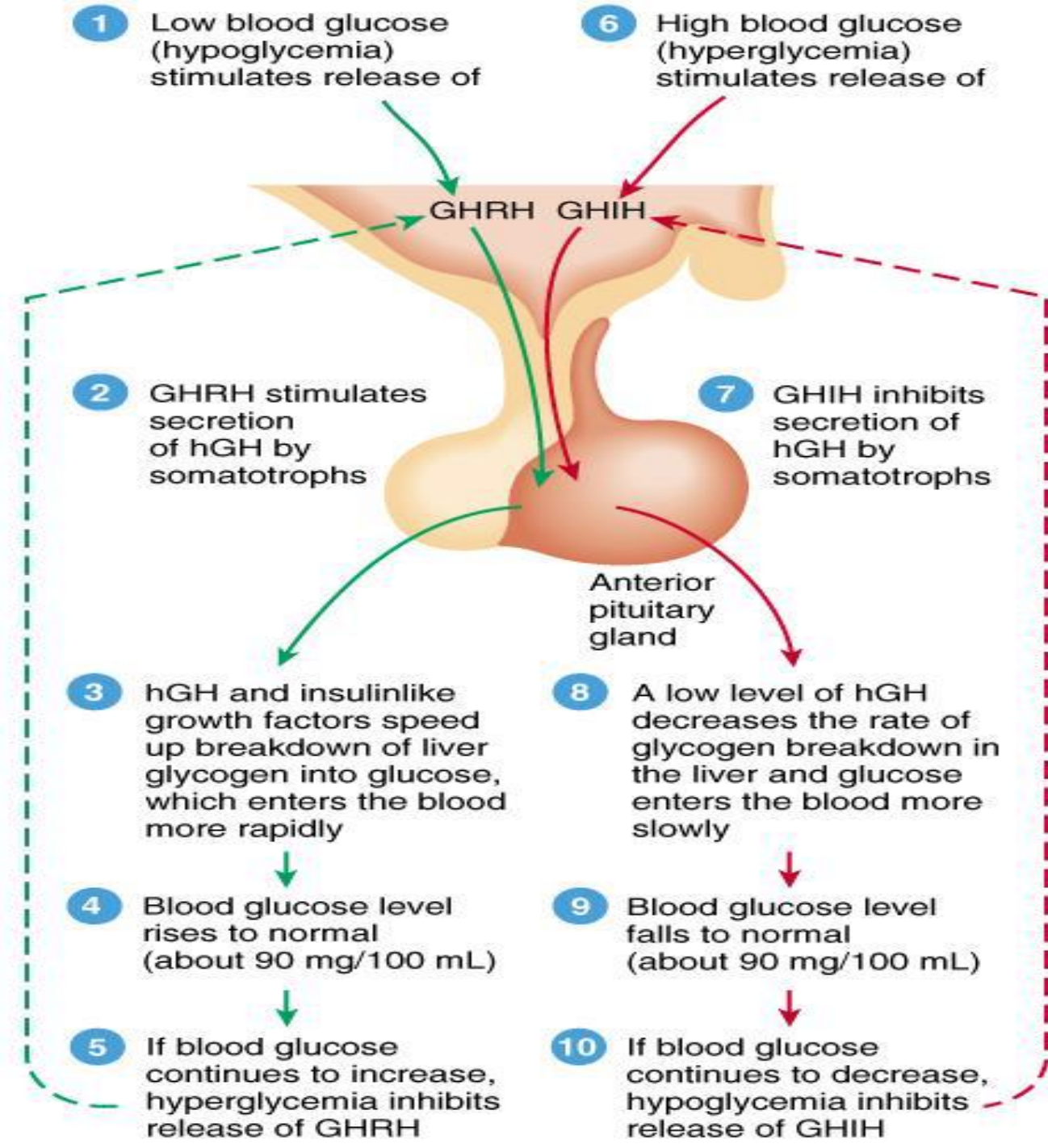


Fig. 2

Gonadotropin releasing hormone (GnRH)



(GHRH) & (GHIH)



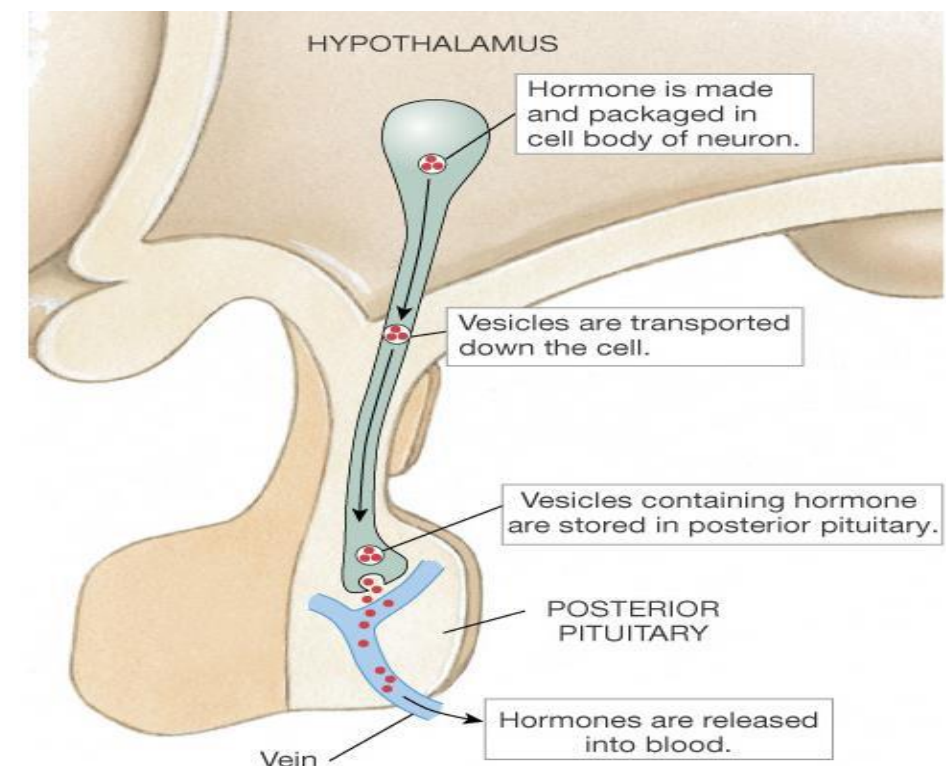
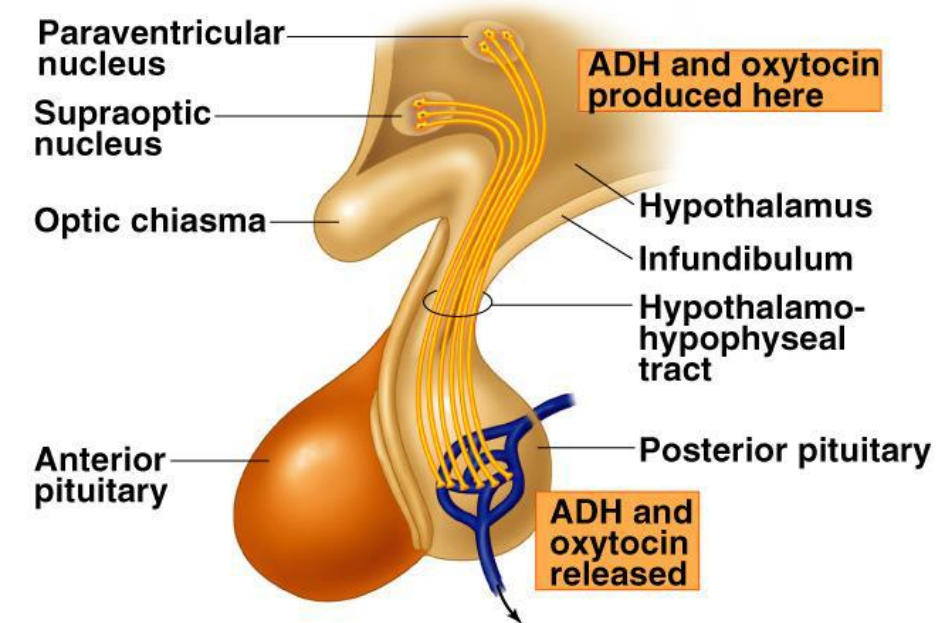
- The posterior pituitary gland is composed mainly of glial-like cells called pituicytes.

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 supraoptic and paraventricular nuclei secrete ADH (vasopressin) and oxytocin directly into capillaries in the posterior lobe.

Hypothalamic control of posterior pituitary



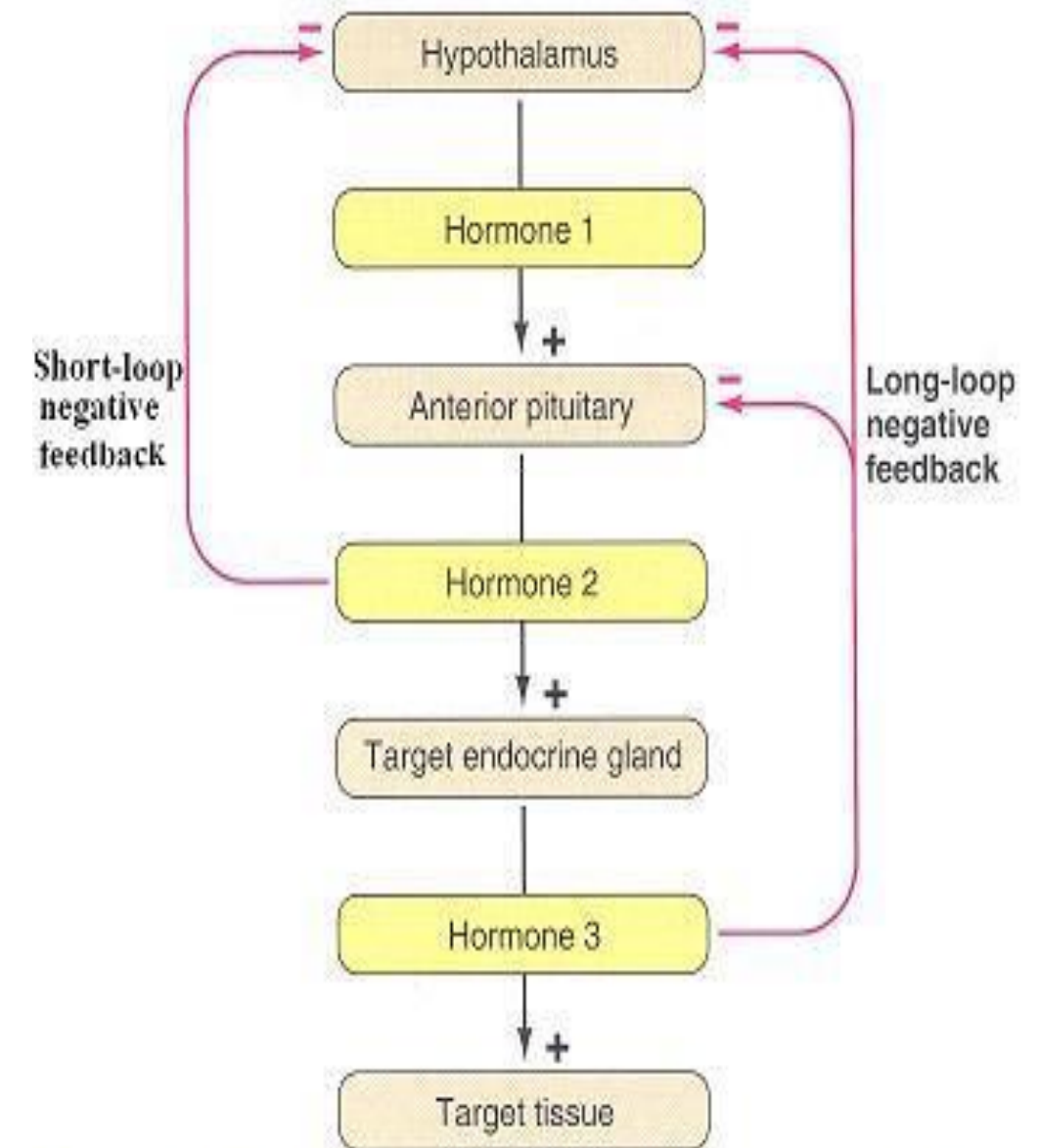
Feedback control of hormone secretion

Negative Feedback : The Dominant

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**.

Simply : when the rate of the production decreases as the concentration of the product increases



Negative feedback in hypothalamic-anterior pituitary control systems

Feedback control of hormone secretion

Positive feedback :

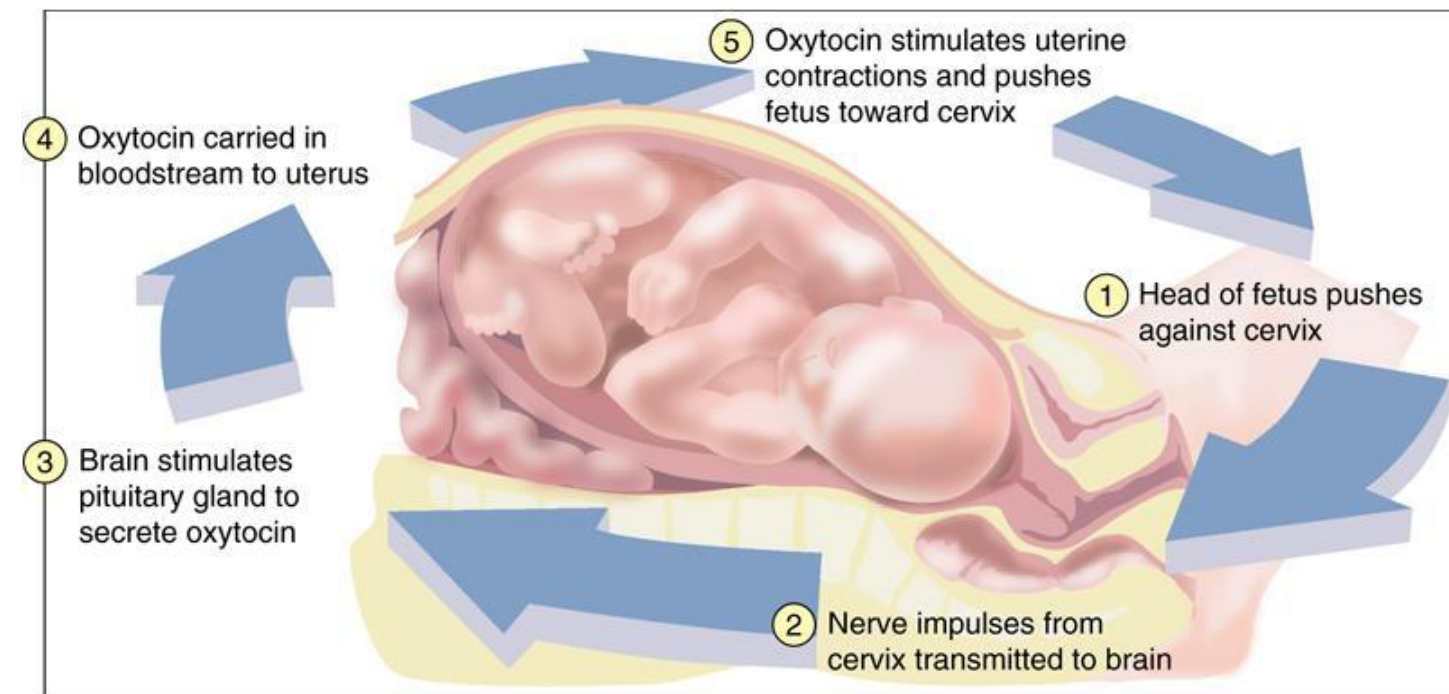
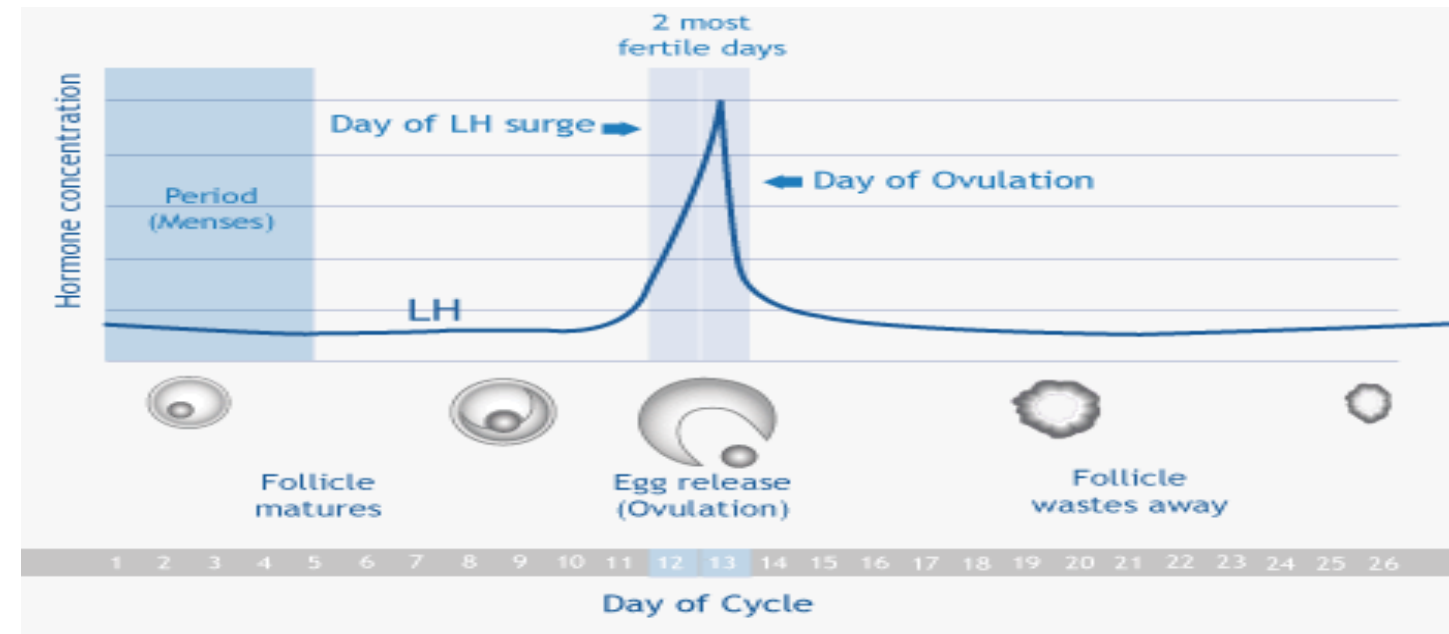
It occurs when the biological action of the hormone causes additional secretion of the hormone.

Example:

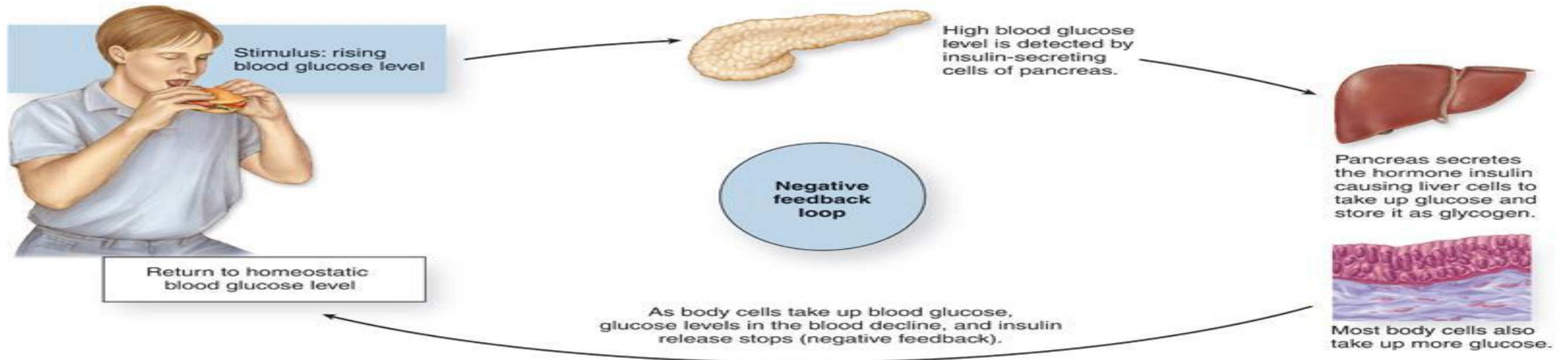
The LH surge (the sudden release of luteinizing hormone that causes the follicle to release a mature egg) occurs as a result of the stimulatory effect of E2 (Estrogen) on the anterior pituitary before ovulation.

The secreted LH then acts on the ovaries to stimulate secretion of E2, which in turn causes more secretion of LH.

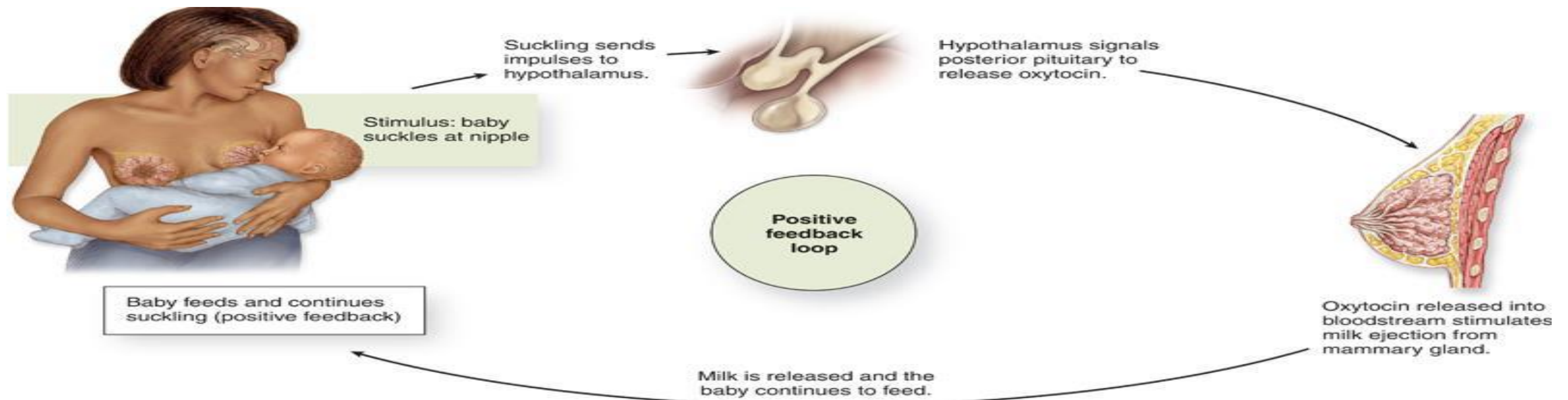
Eventually, LH reaches an appropriate concentration, and typical negative feedback control of hormone secretion is then exerted.



Negative Feedback Vs Positive feedback



(a) Negative feedback



(b) Positive feedback

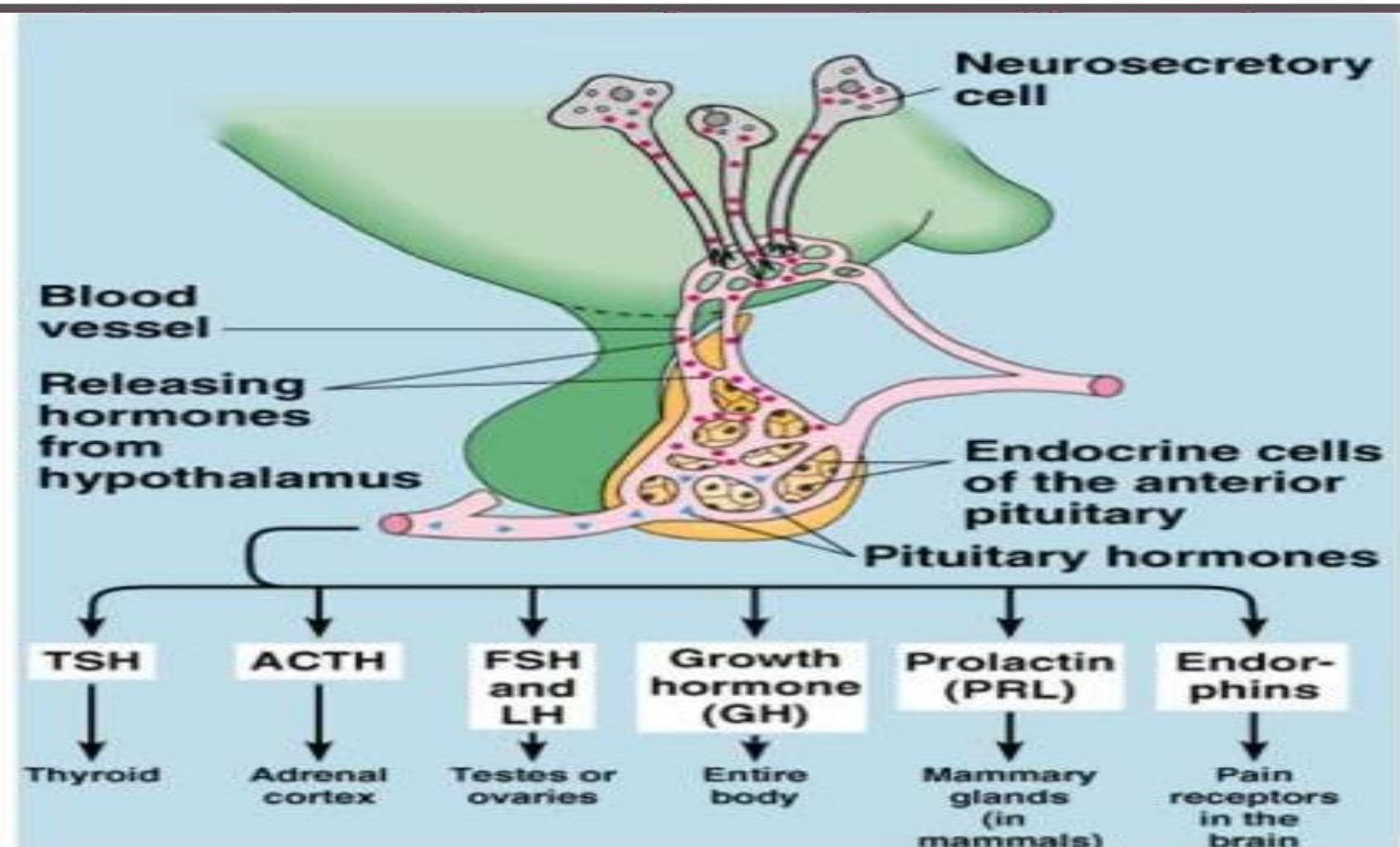
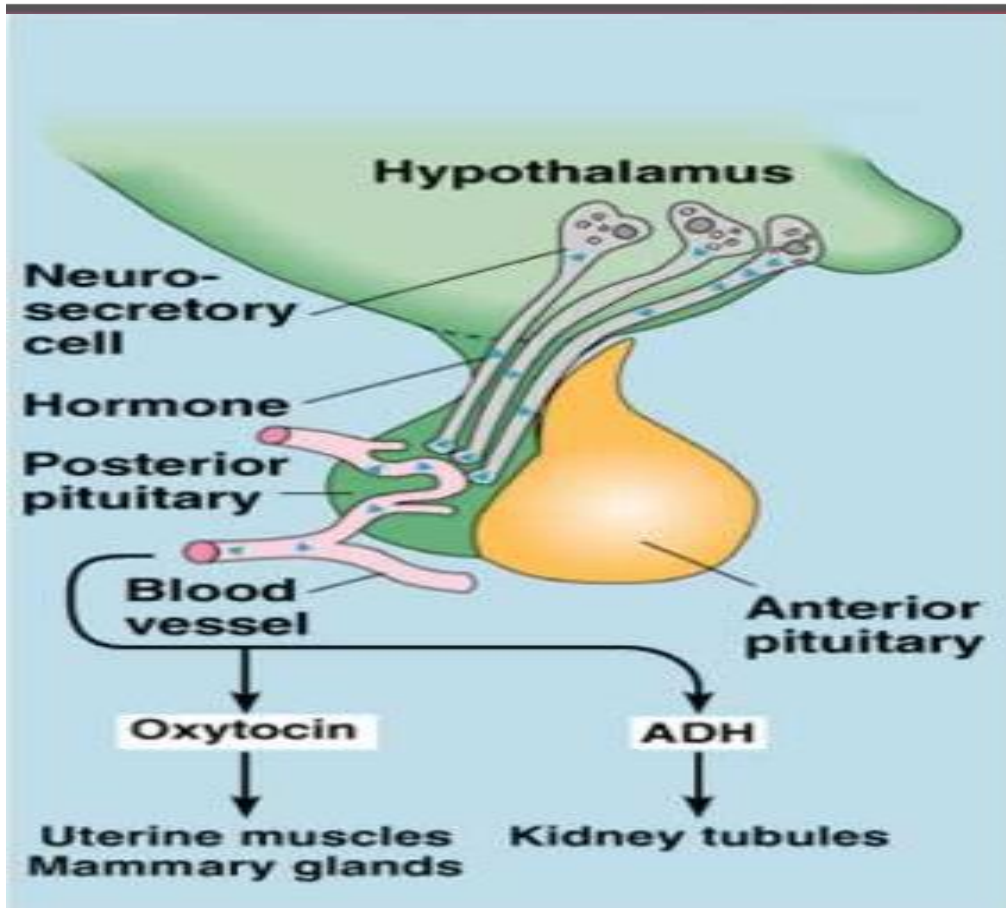
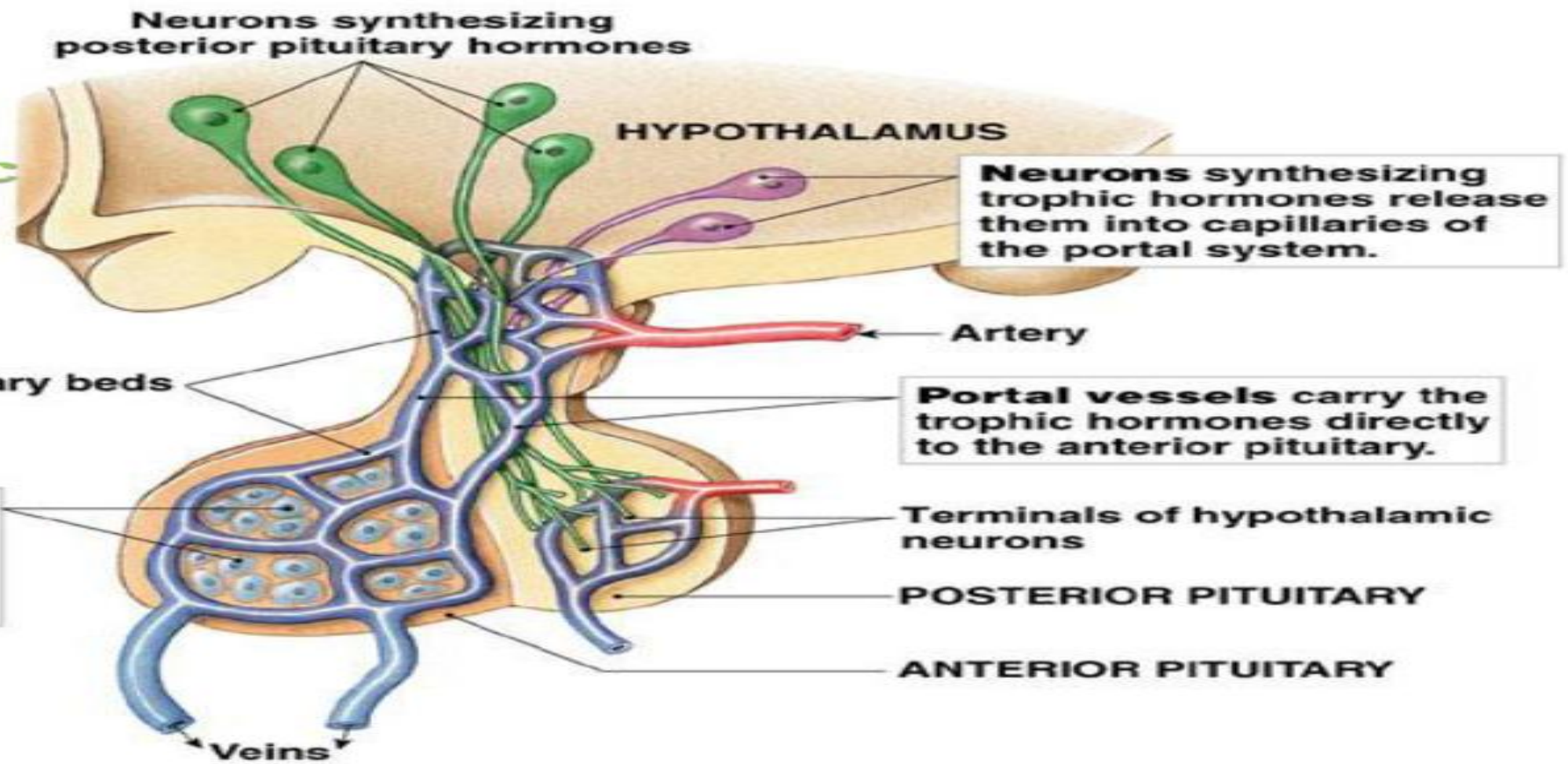
Summary

A. Hypothalamic–pituitary relationships

- 1. The anterior lobe of the pituitary gland is linked to the hypothalamus by the hypothalamic–hypophysial portal system.** Thus, blood from the hypothalamus that contains high concentrations of hypothalamic hormones is delivered directly to the anterior pituitary. Hypothalamic hormones [e.g., growth hormone–releasing hormone (GHRH)] then stimulate or inhibit the release of anterior pituitary hormones (e.g., growth hormone).
- 2. The posterior lobe of the pituitary gland is derived from neural tissue. The nerve cell bodies are located in hypothalamic nuclei.** Posterior pituitary hormones are synthesized in the nerve cell bodies, packaged in secretory granules, and transported down the axons to the posterior pituitary for release into the circulation.

Summary of Hypothalamic Control of Pituitary Gland

Endocrine cells release their hormones into the second set of capillaries for distribution to the rest of the body.



MCQs

Q1) The body's 'master gland' is the:

- A) Thyroid gland.
- B) Parathyroid gland.
- C) Pituitary gland.
- D) Pancreas.

Q2) Which of the following hormones originates in the anterior pituitary:

- A) Growth hormone–releasing hormone(GHRH)
- B) Somatostatin
- C) Gonadotropin-releasing hormone(GnRH)
- D) Thyroid-stimulating hormone (TSH).

Q3)which of the following hormones is secreted by lactotropes cell?

- A)TSH .
- B)GH.
- C)Prolactin.
- D)ACTH.

Q4) Which of the following substances is derived from pro-opiomelanocortin(POMC):

- A) Adrenocorticotrophic hormone (ACTH)
- B) Follicle-stimulating hormone (FSH)
- C) Melatonin
- D) Cortisol

Q5) which of the following is feature of adenohipophysis :

- A-Storage of Hormones
- B-Has Neural nature
- C-Controlled by Nervous signals
- D-Connected with Hypothalamus by Vascular connection

1-C

2-D

3-C

4-A

5-D



@PhysiologyTeam



Pht433@gmail.com



Physiology team

Done by :
TURKI ALOTAIBI
Revised by:
Rahma Alshehri

Endocrine Block