

HYPOTHALAMIC-PITUITARY AXIS

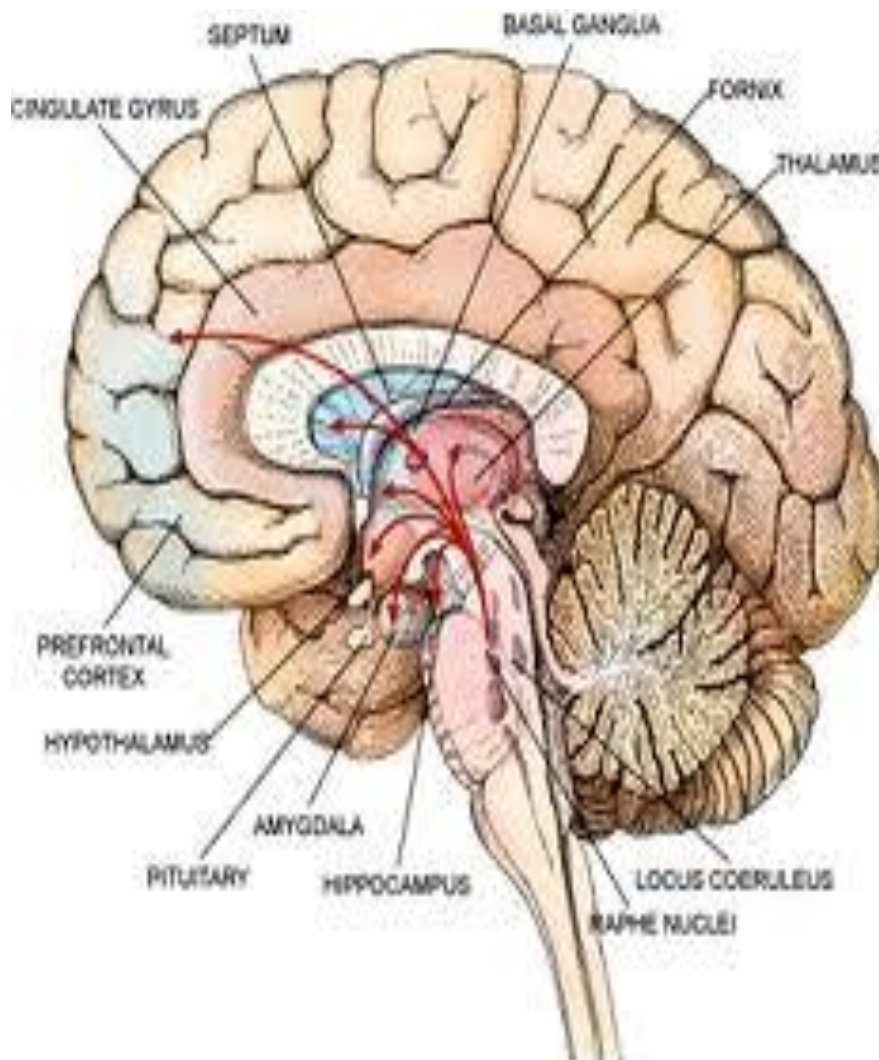
قام بالمراجعته والتدقيق : محمد المومي

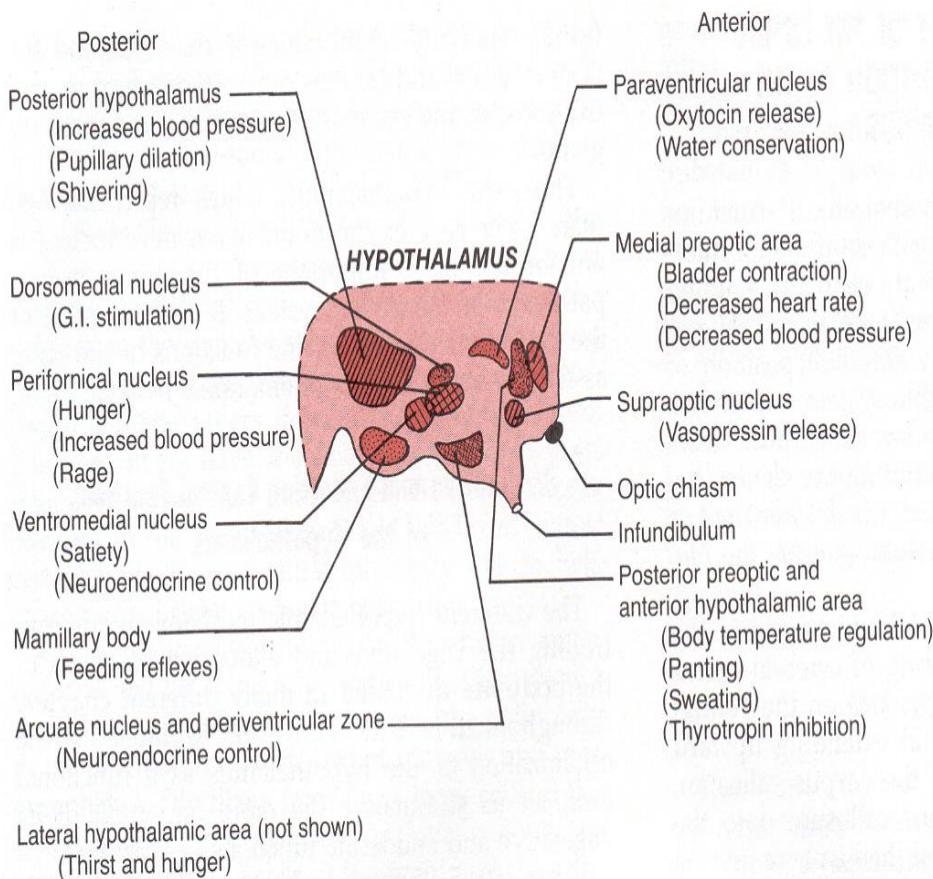
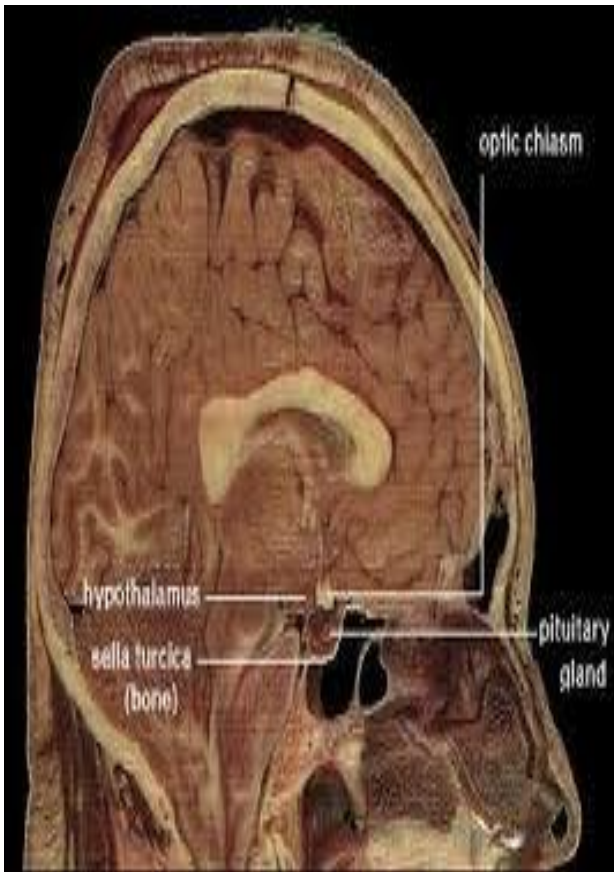
HYPOTHALAMIC-PITUITARY AXIS

- Hypothalamic and pituitary glands Coordinate the other glands in the body .
- **EX:** Thyroid gland, adrenal gland, reproductive gland, control growth, milk production, osmoregulation.

1- HYPOTHALAMUS

- Control pituitary gland secretion by its hormones action.
- Composed of number of nerve cells which called (nuclei) .





Hypothalamus and Pituitary Gland

- Thirst and drinking are triggered by signals** received from osmoreceptors which detect concentrations of substances in the blood and promptly send messages that they need to drink. Other hypothalamic areas and their activity are used to control various other body functions, such as the release of hormones.
- Body rhythmic cycles are controlled** by the hypothalamus and its hormonal links. You need both sets of body systems to affect the sleep to regulate and the behavior which comes from this. An upper motor neuron before when when a person sleep or a response to avoid behavior, such as avoidance of the ground or a jump.
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HORMONES which secreted by hypothalamic gland :

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

تركيب كل هرمون ووظيفته مهمه – انظر الجدول – وكلها ستفصل بالصفحات القادمه

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

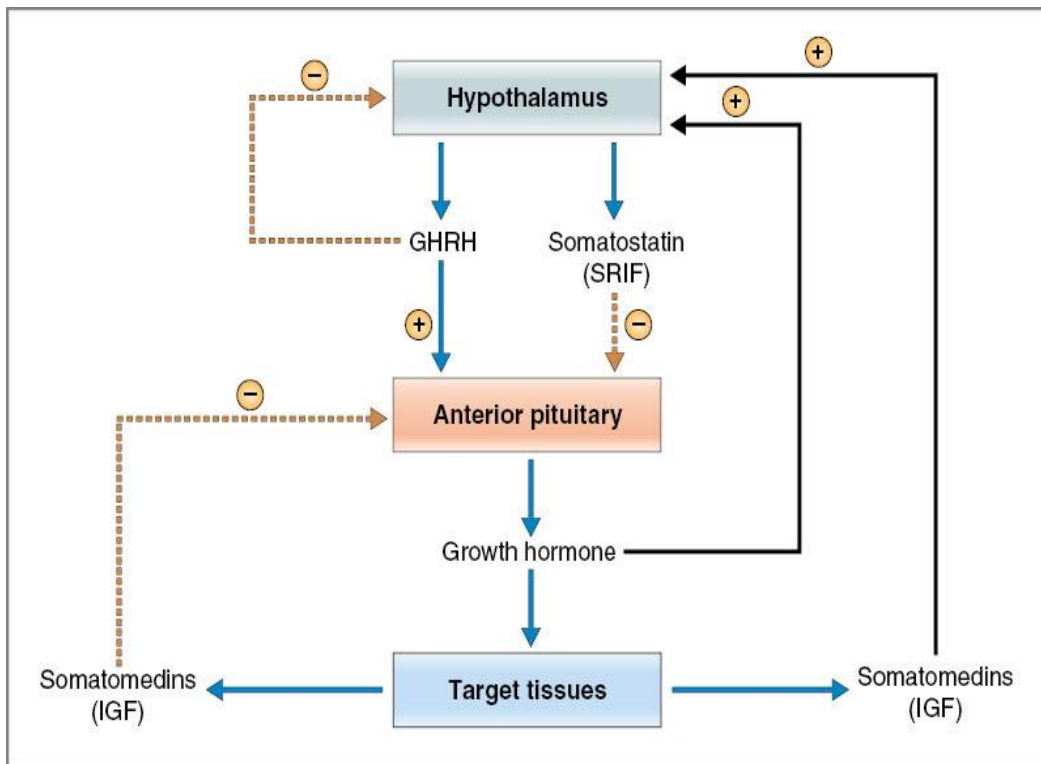
1-GHRH/GHIH(SRIF)

The chemical structure : Both of GHRH/GHIH(SRIF) are Peptide hormones

The Action : - GHRH hormone stimulate the secretion of (Growth Hormones) from anterior pituitary gland

- While the GHIH (SRIF) inhibit secretion of Growth Hormon

العملية تشرح لاحقا في الدرس القادم

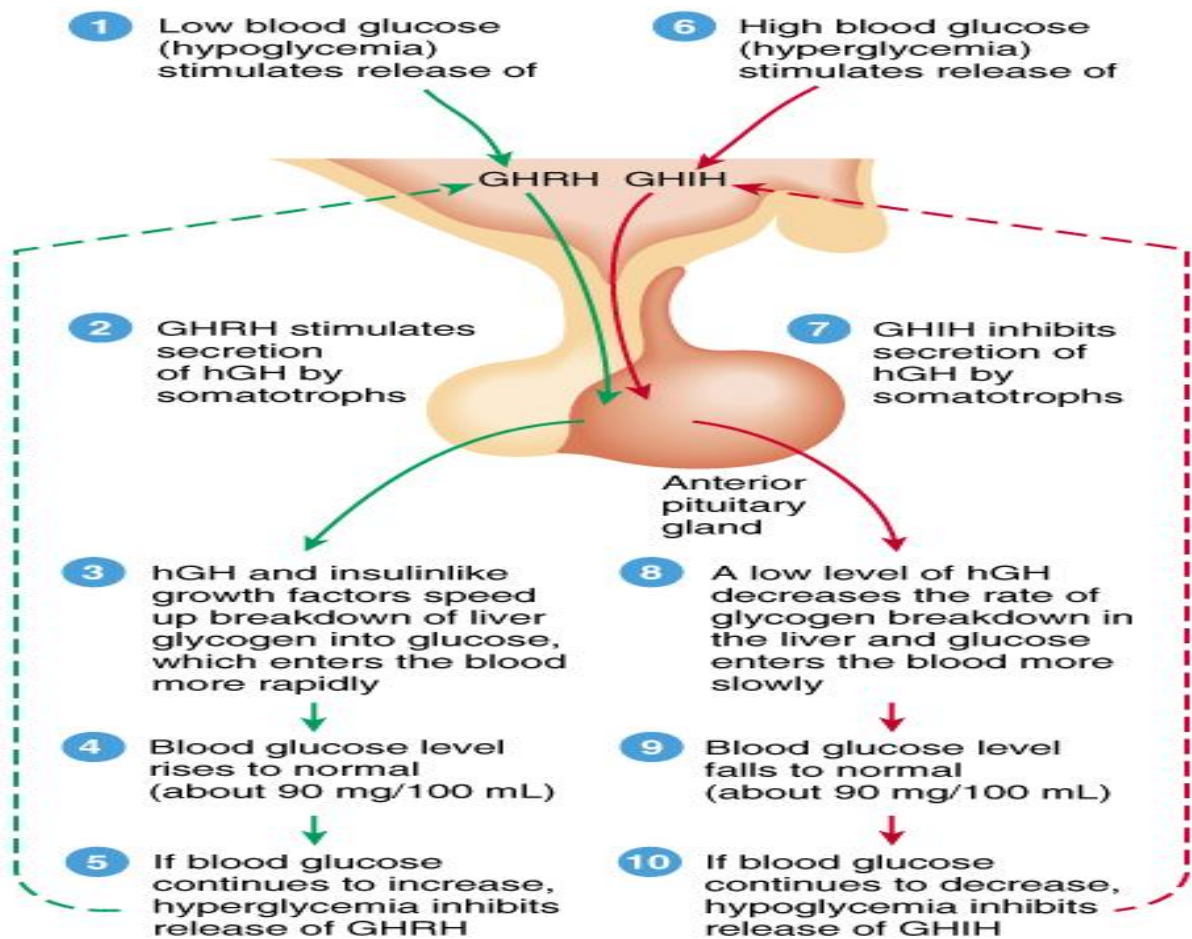


Growth hormone : Increase the glucose blood level -

so if the glucose blood level increase it inhibit the secretion of the GH

and if it decrease it stimulate the secretion of GH

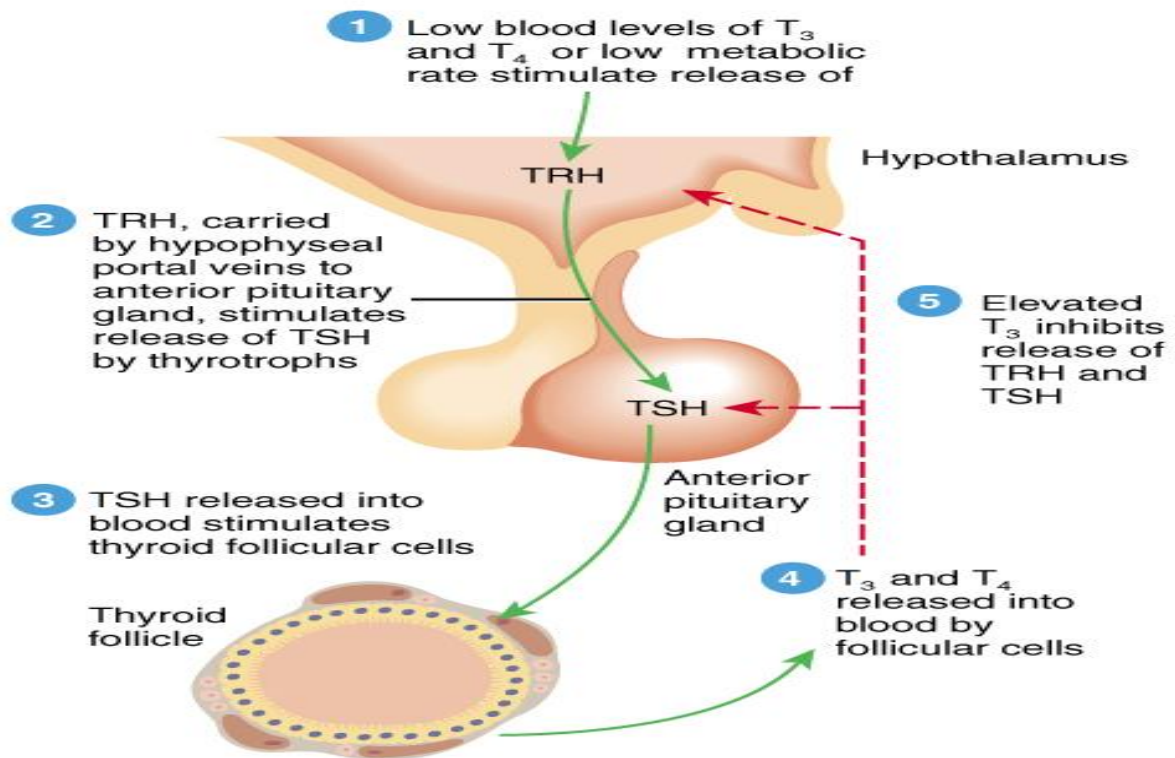
كل هذا يفصل لاحقا الدرس القادم



2-TRH

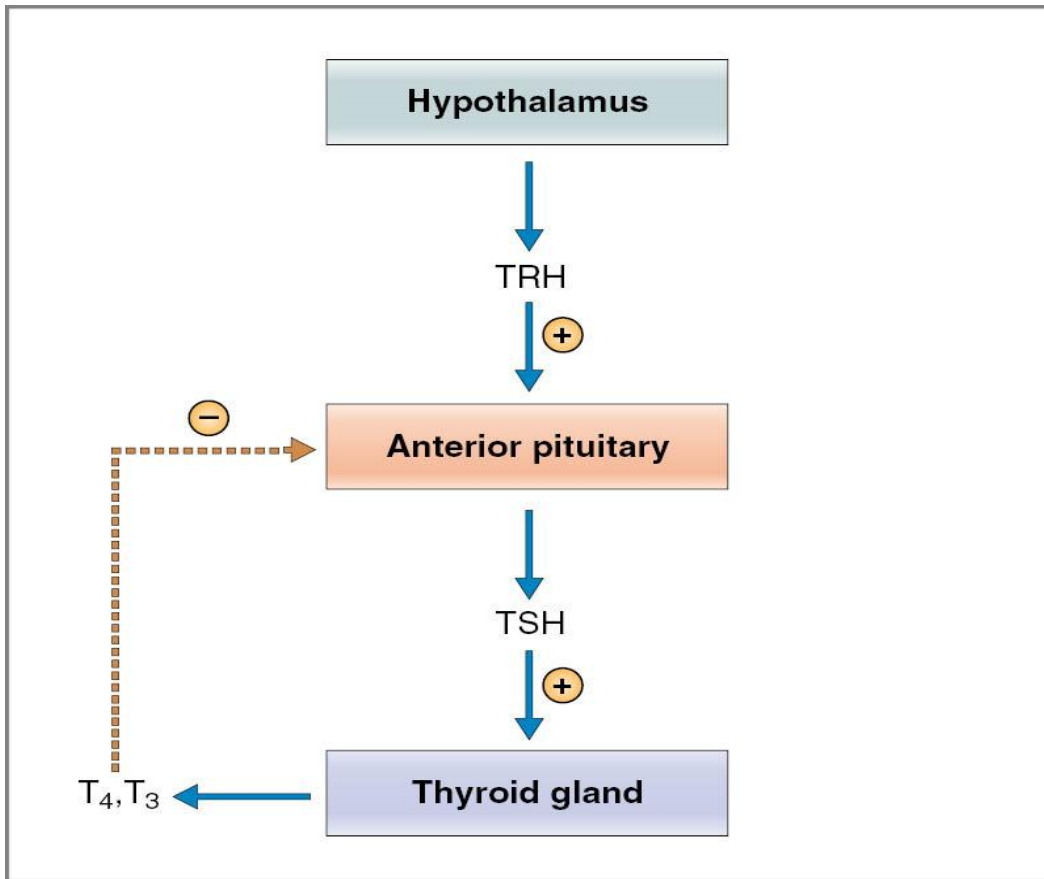
The chemical structure : Peptide Hormone

The Action : it control secretion of (TSH – thyroid stimulating hormone – and prolactin hormone) كل هذا يفصل لاحقا الدروس القادمة



Key:

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



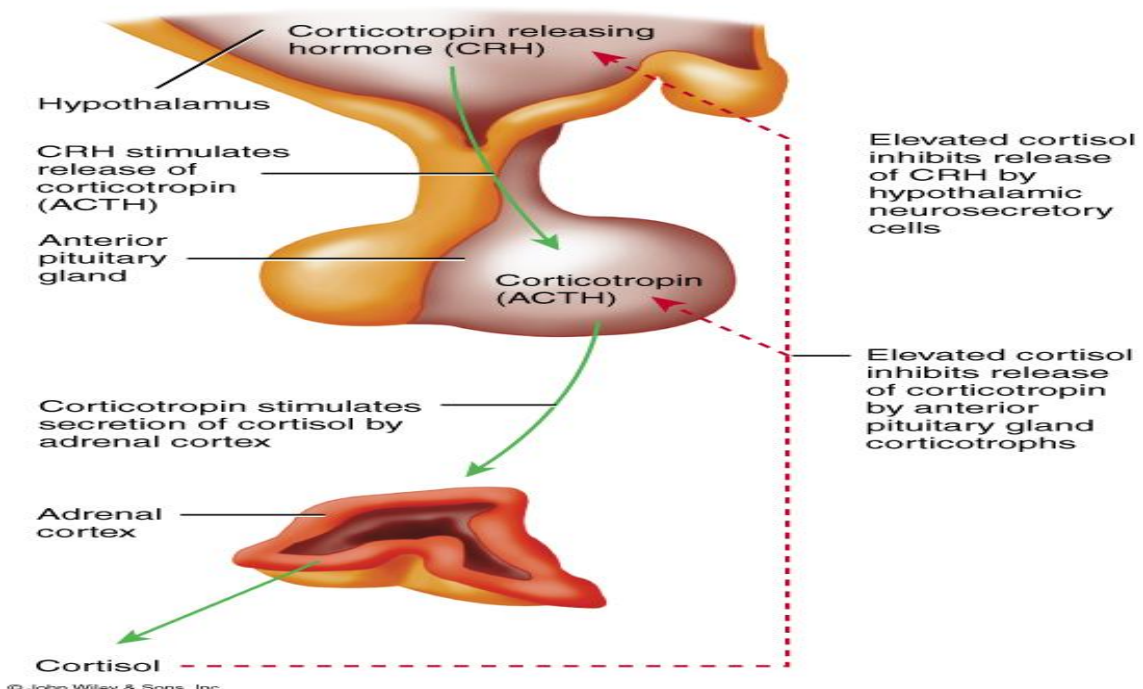
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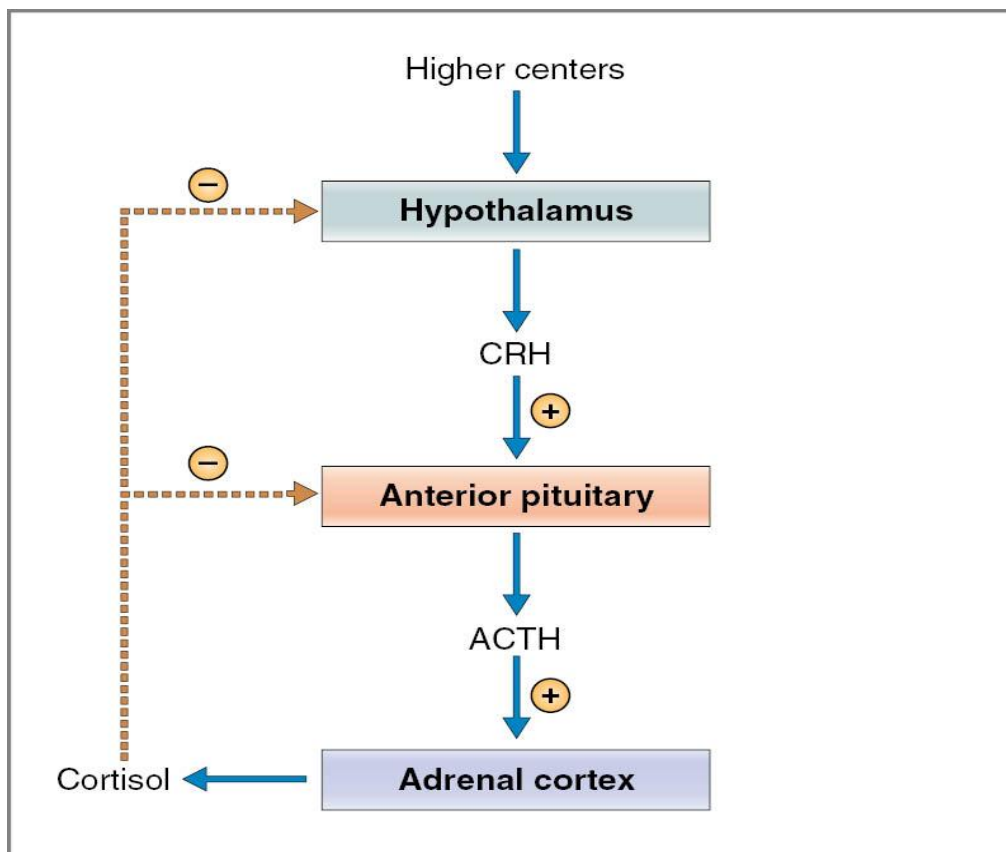
3-CRH

The chemical structure : Peptide Hormone

The Action : stimulate secretion of Cortisol by Stimulating of secretion of ACTH from anterior pituitary gland كل هذا يفصل لاحقا الدروس

القادمة





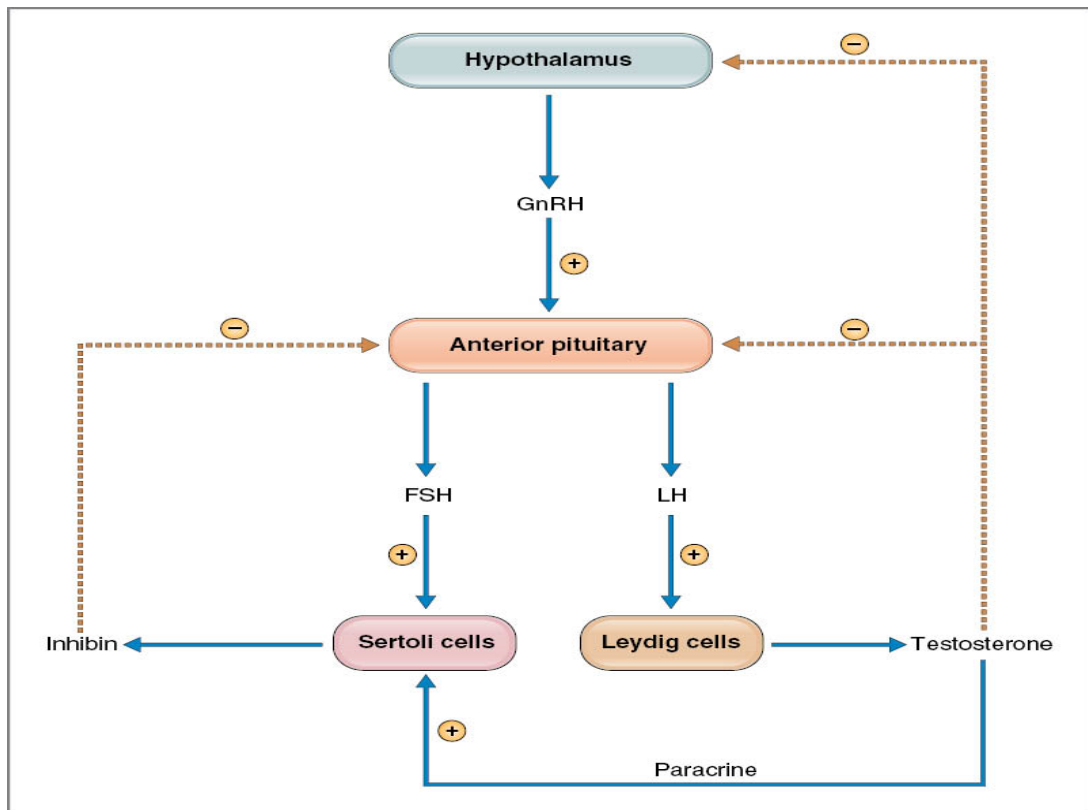
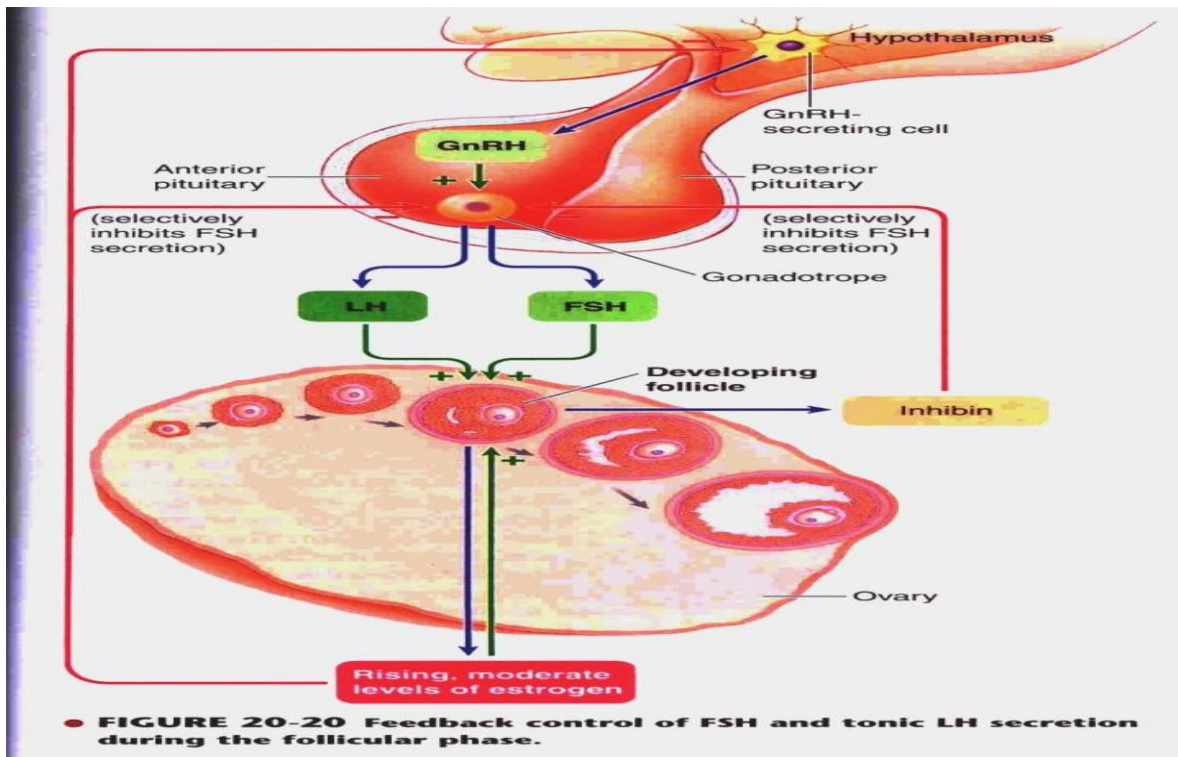
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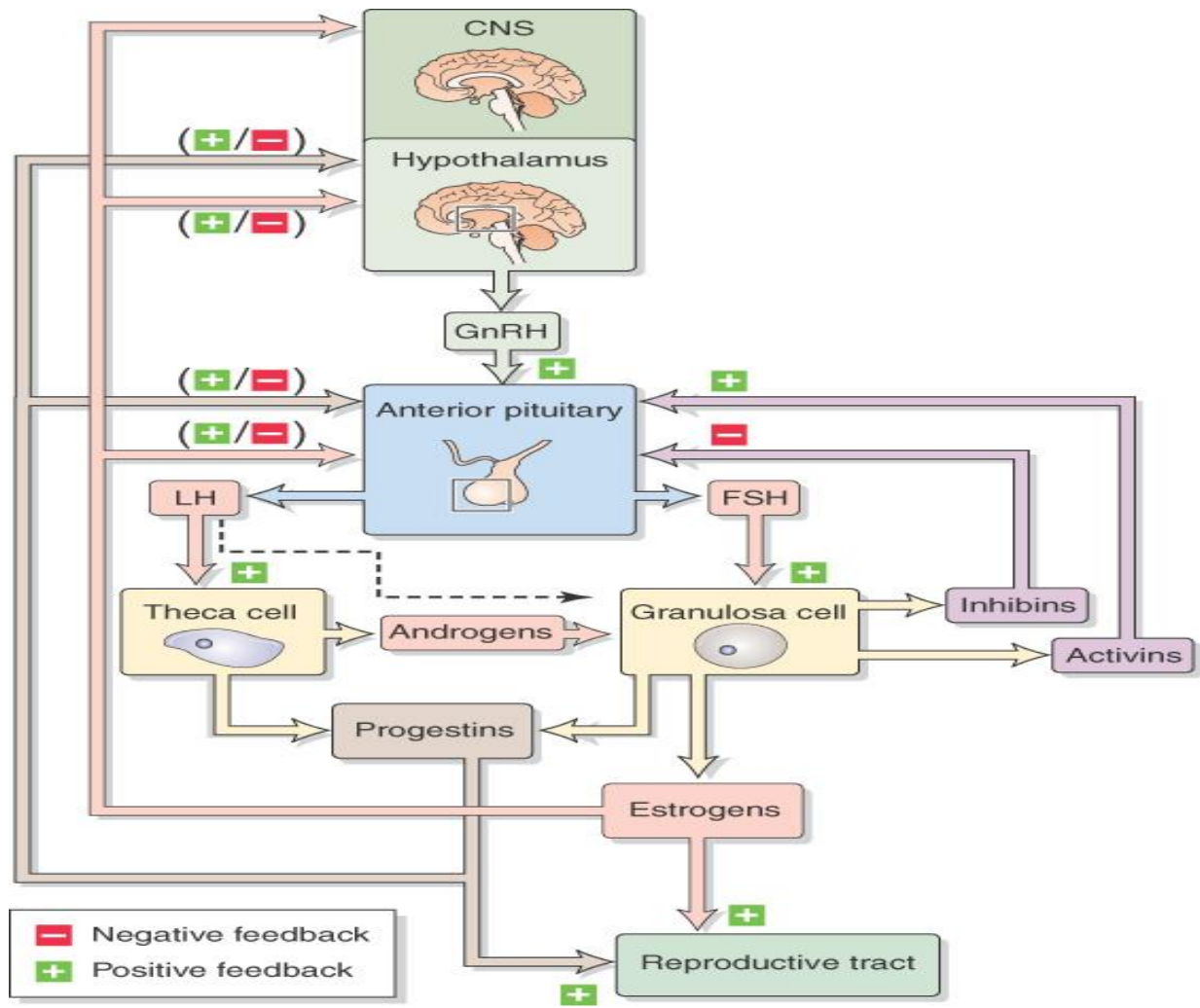
Note that it's feedback on both : hypothalamus & anterior pituitary because it has receptors on both .

4- GnRH

The chemical structure : Peptide Hormone

The Action : control the Gonadal function by stimulate the Anterior pituitary gland to secrete LH – FSH





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5- PIH

Chemical structure : Amine Hormone

Action : inhibit Prolactin secretion by affecting the Dopamine كل هذا

يفصل لاحقا الدروس القادمه

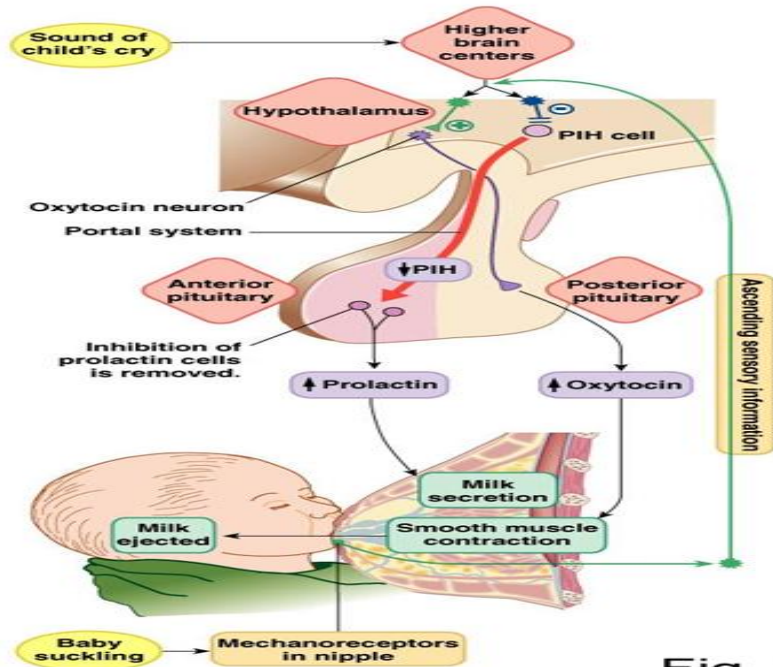
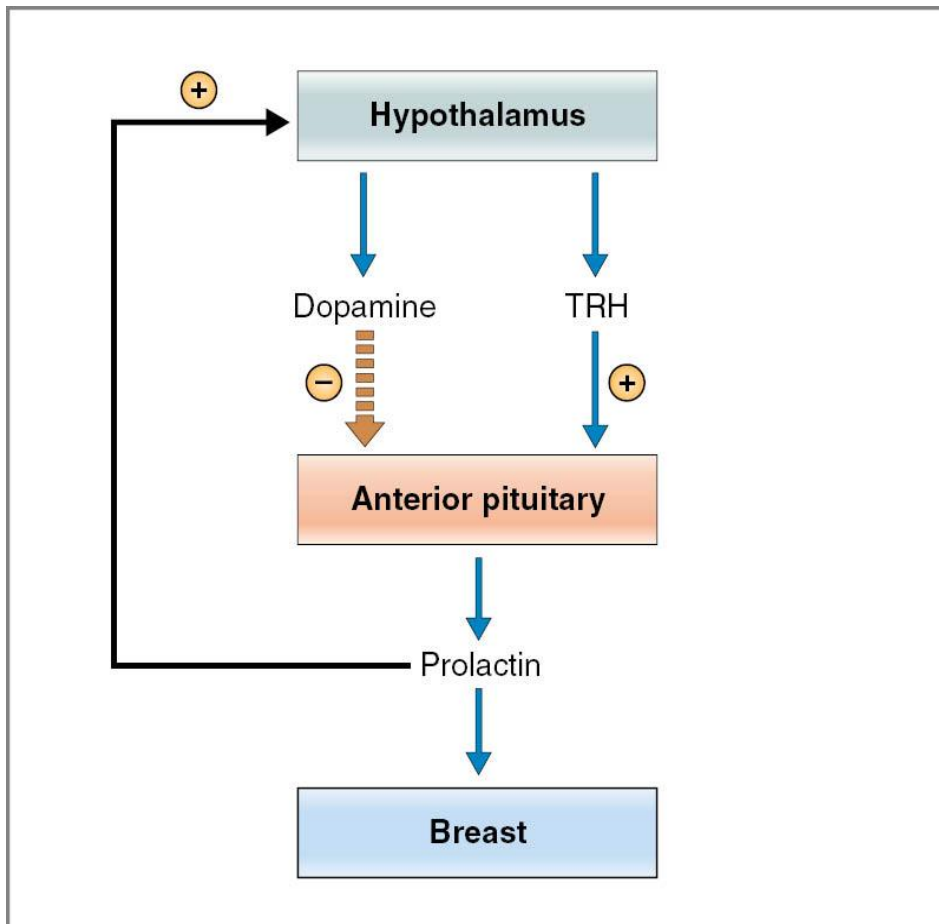


Fig. 26-23

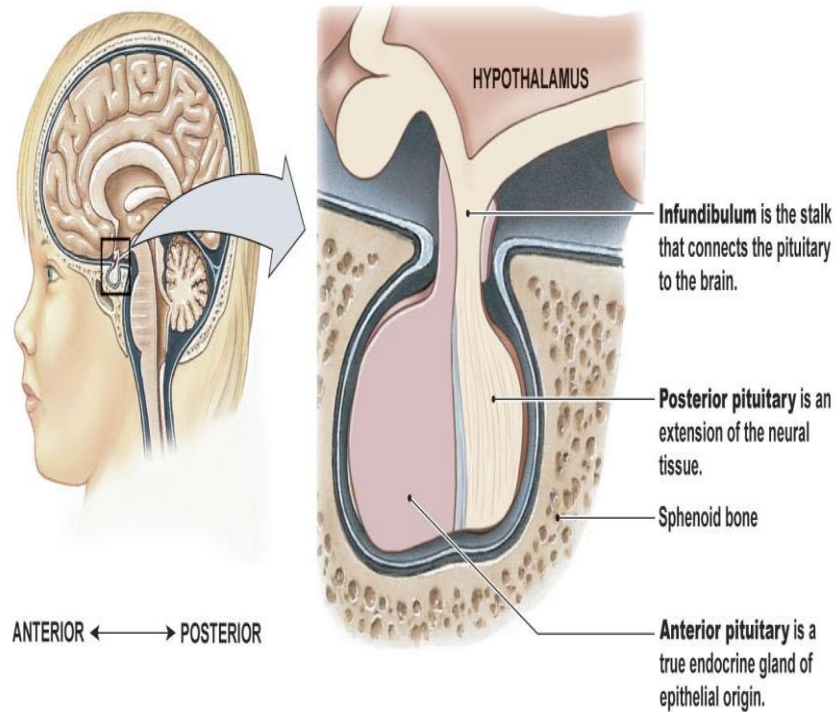
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2- PITUITARY GLAND

- It called also /: Hypophysis.
- Its size is 1cm and it could double up during pregnancy .
- It weight : 0.5-1 gram.



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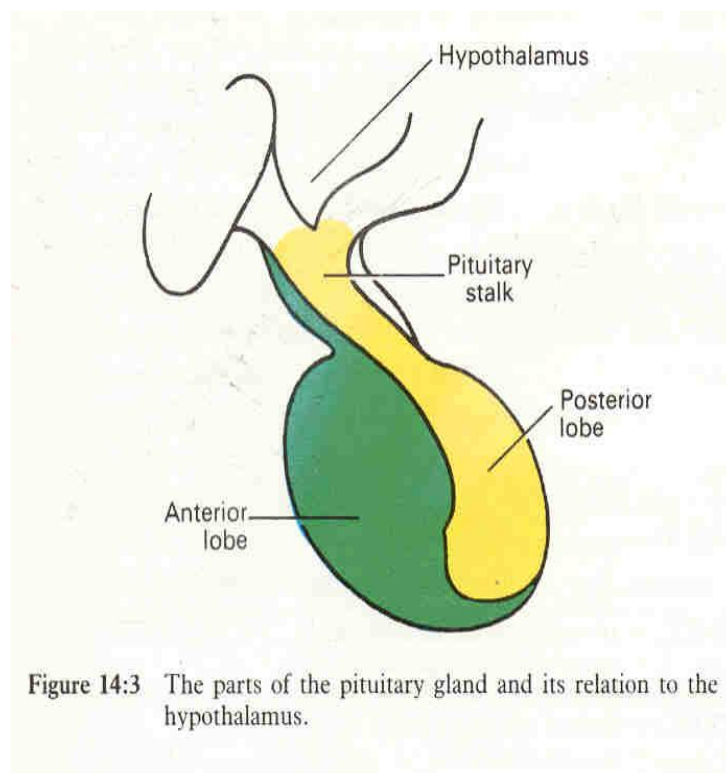


Figure 14:3 The parts of the pituitary gland and its relation to the hypothalamus.

ITS STRUCTURE

It divided into "

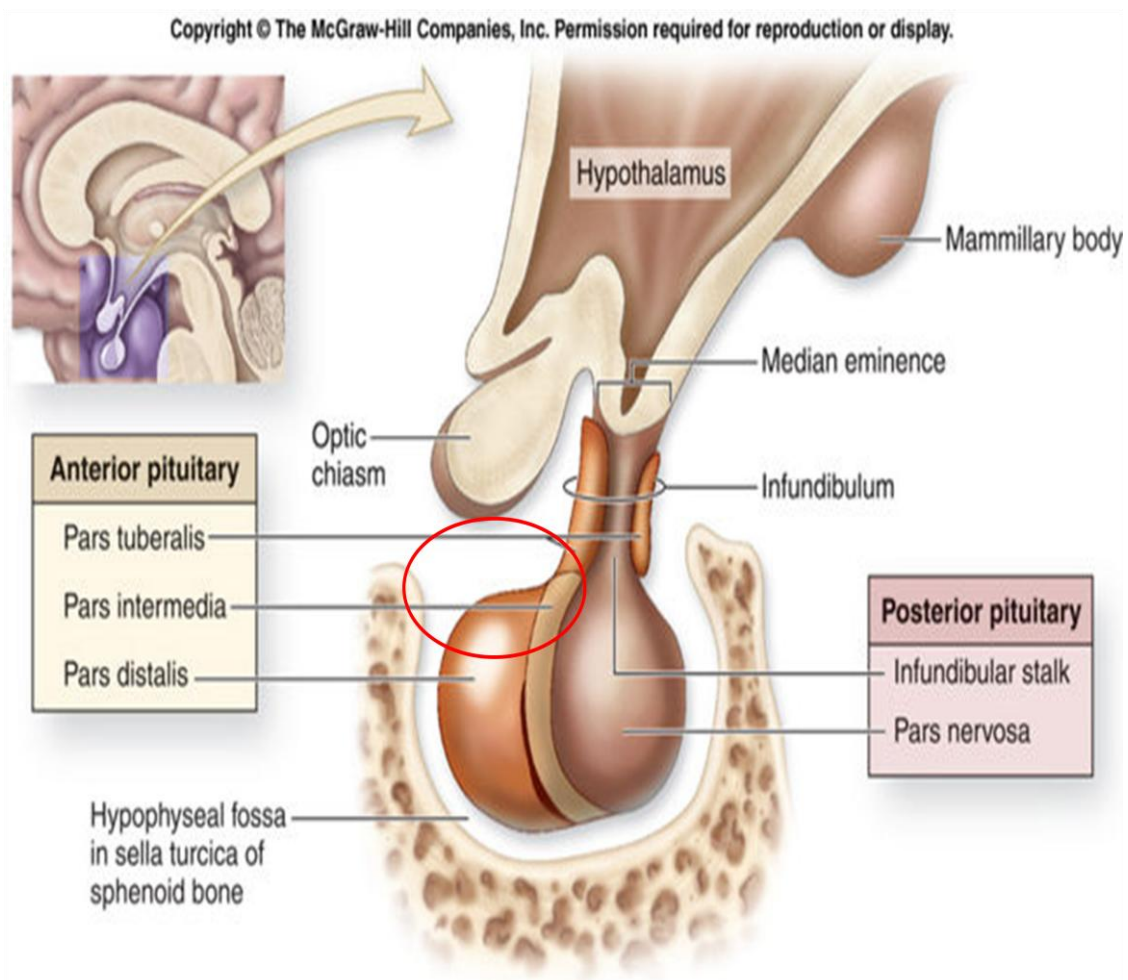
1- Anterior lobe (adenohypophysis).

Divided into : (Parsa Tubularis – Parsa intermedia – Parsa distalis)

2- Posterior lobe (neurohypophysis).

Divided into (parsa nervosa – infundibulum stalk)

3- Infundibulum. (it also called infindibulume stalk) → it connect the pituitary gland to the Hypothalamic gland



RELATIONSHIP OF THE HYPOTHALAMUS TO THE POSTERIOR PITUITARY

The Histological structure of the pituitary gland is : Collection of nerve axons +supporting cells.

While the Hypothalamic gland form of Nuclei which the most important ones of them are :

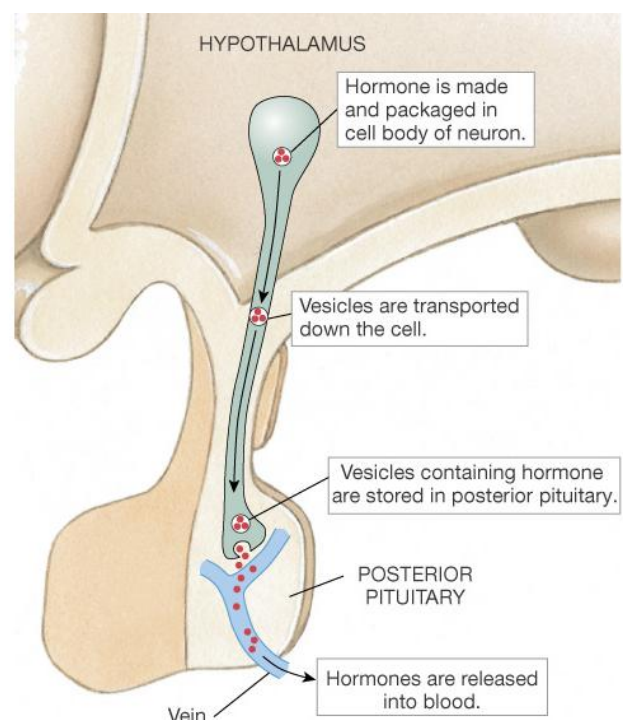
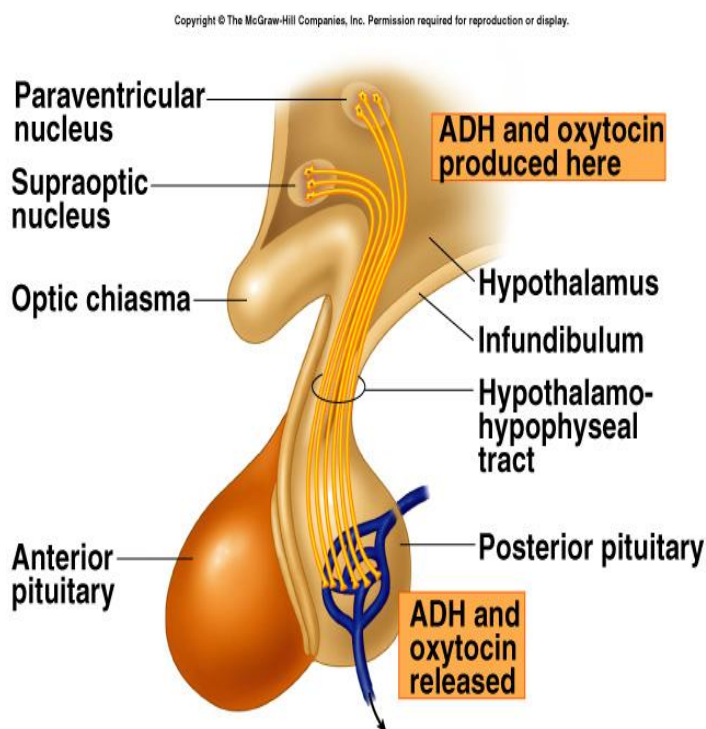
1- Supraoptic nuclei.

Which synthesis : Antidiuretic hormone (ADH).

2-Paraventricular nuclei

Which synthesis : Oxytocin.

Both of these two hormones (stored and release) from the Posterior pituitary Gland



The connection between Hypothalamus and Pituitary Gland :

1- Between Hypothamic and Posterior Pituatry gland :

HYPOTHALAMO-NEURO HYPOPHYSIAL TRACT

Which is 100% neural tract that delivered the hormones which synthsis in the Hypothalamic to Posterior Pituitary gland as following :

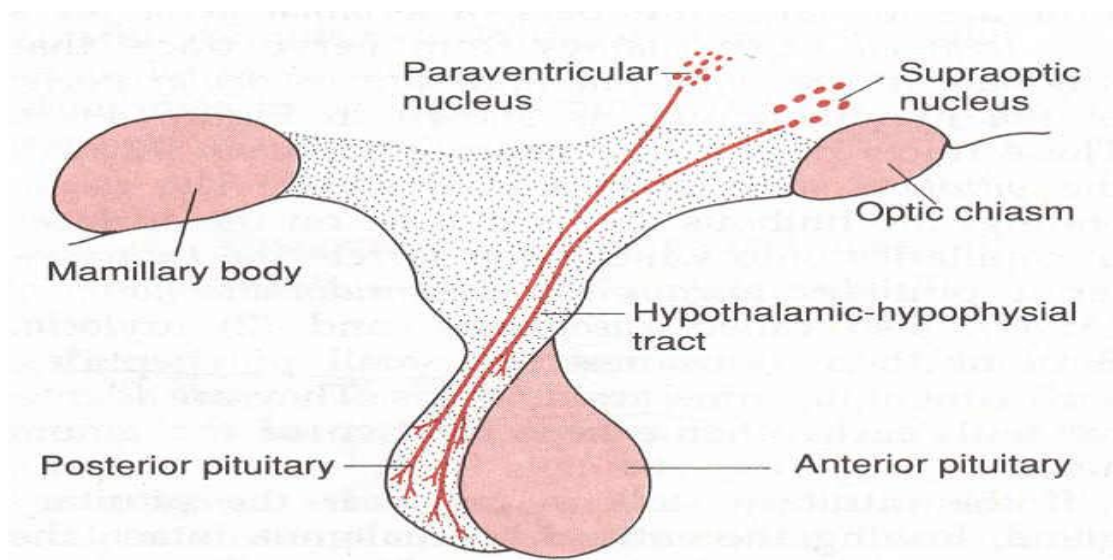
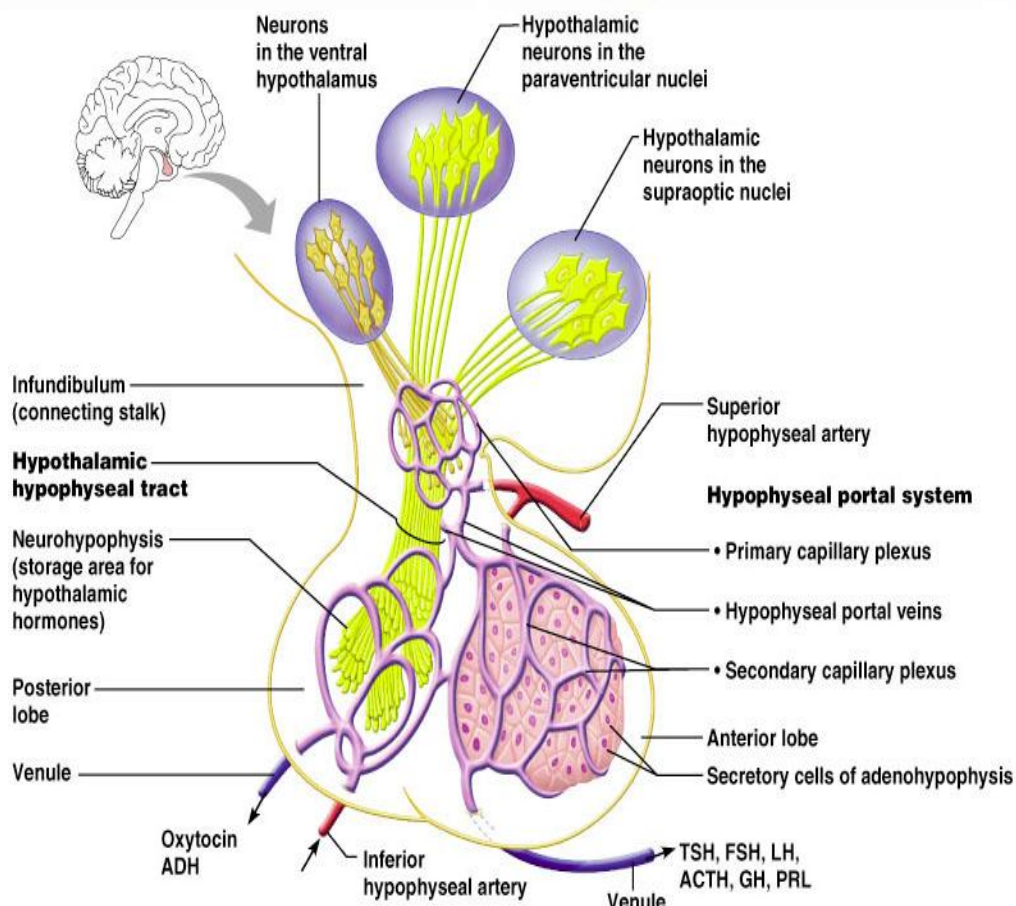


Figure 49-9 Hypothalamic control of the posterior pituitary.



2- RELATIONSHIP OF THE HYPOTHALAMUS TO THE ANTERIOR PITUITARY

The Anterior pituitary gland is form of collection of 5 endocrine glands which form of 5 different cells

These cells produce 6 type of hormones : .

1- TSH

2- FSH

3- LH

4- GH

5- PROLACTIN

6- ACTH.

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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

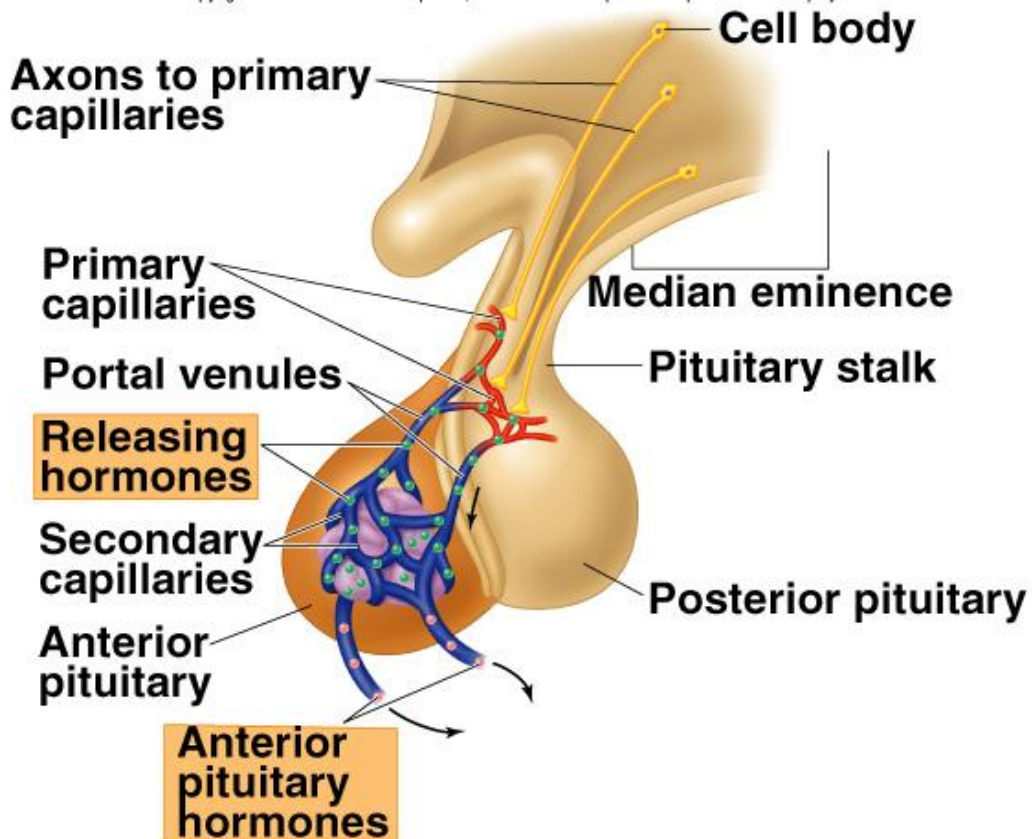
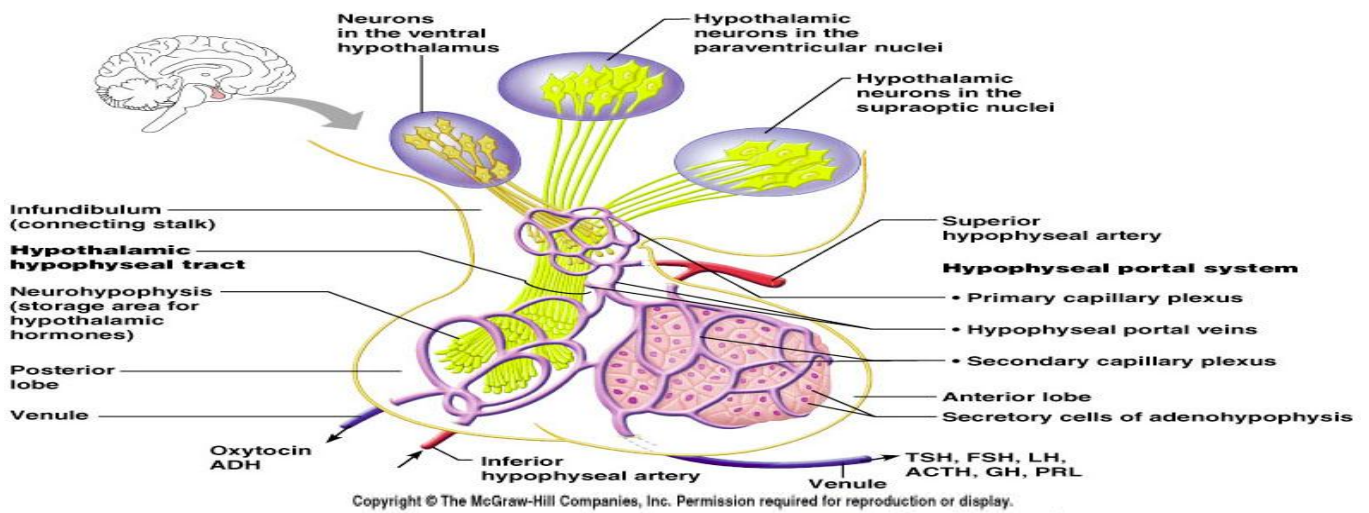
The connection between the Hypothalamic and Anterior pituitary gland is via 2 ways :

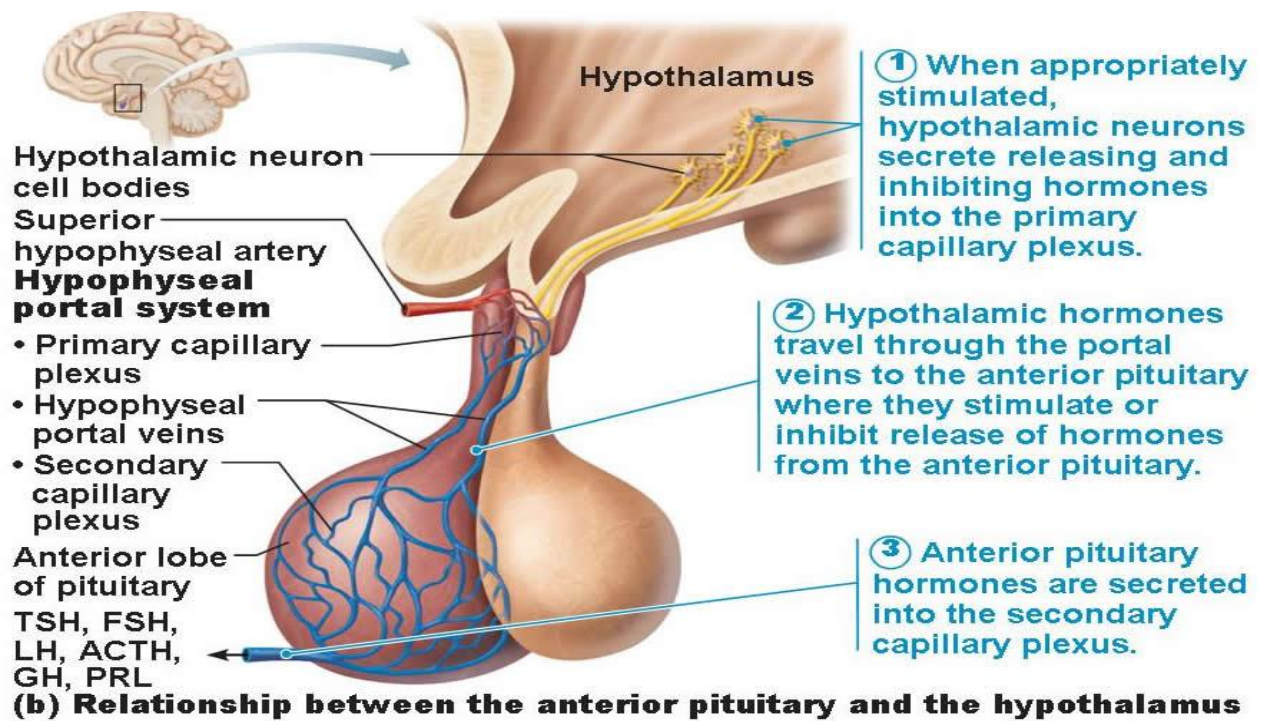
1- HYPOTHALAMIC-HYPOPHYSIAL PORTAL SYSTEM

Which form of 2 sets of capillaries (primary and secondary) **حيث** :

The Hypothalamic gland secrete it hormones in the 1st set of capillaries (primary) then these hormones delivered to the Anterior pituitary gland

The Anterior pituitary gland then secrete its hormones in the 2nd sets of capillaries (secondary) which then delivered to the body

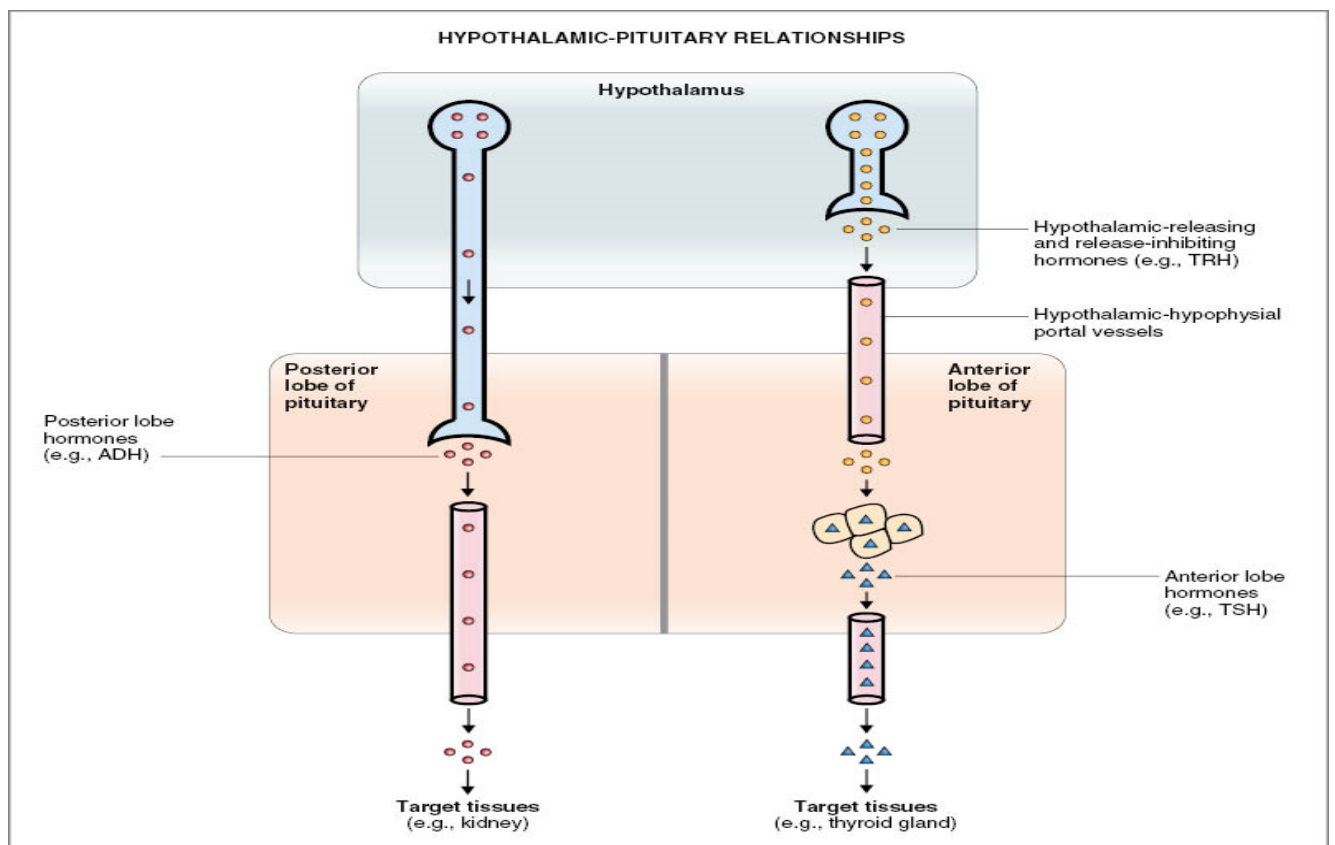




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- 2- via : neural way.

ملخص لما سبق



the connection between hypothalamus and anterior pituitary is : Neural and endocrine which differ from the posterior which mainly and only Neural .

NEGATIVE FEEDBACK MECHANISM الرسمه واضحه وتشرح نفسها

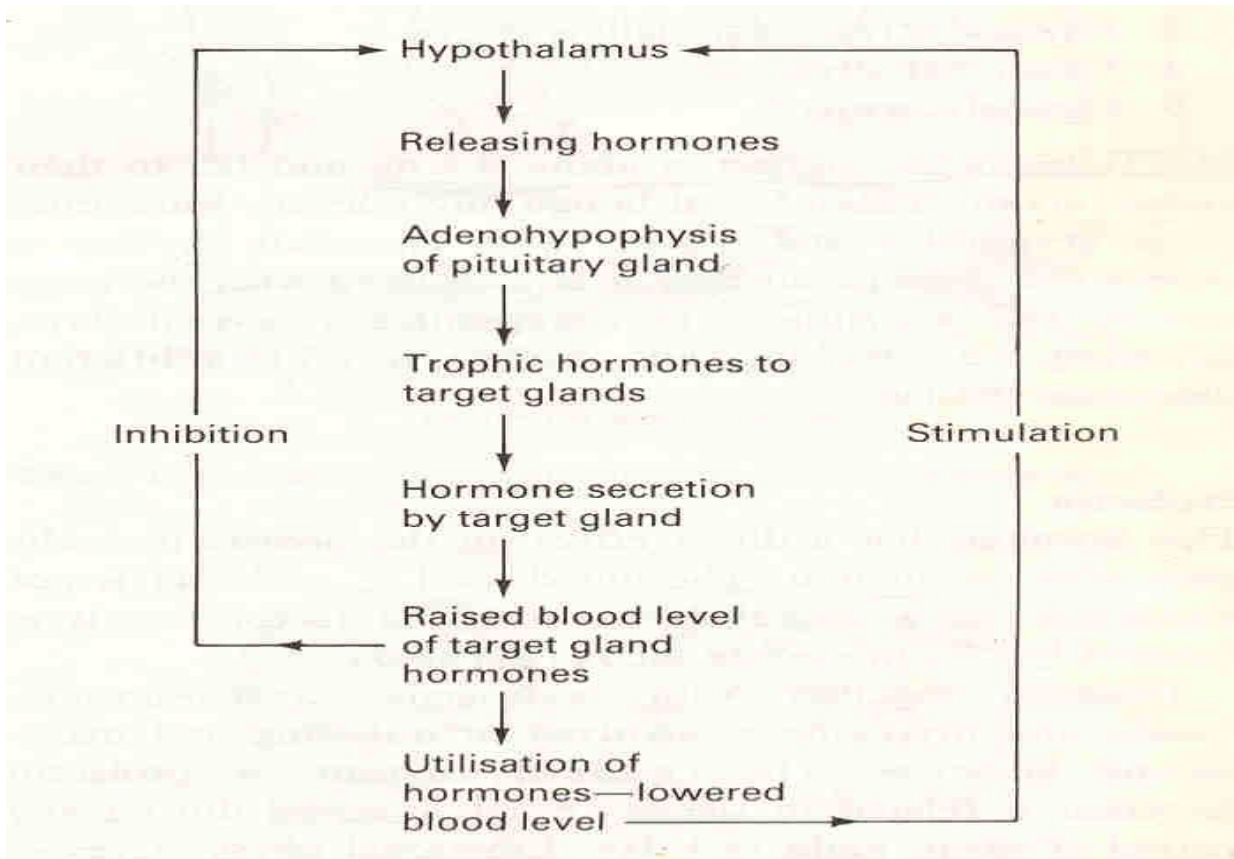
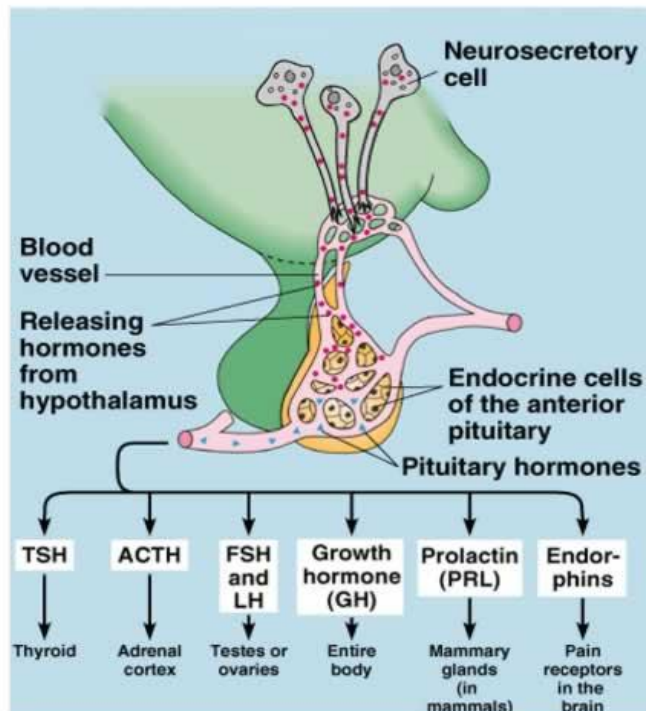
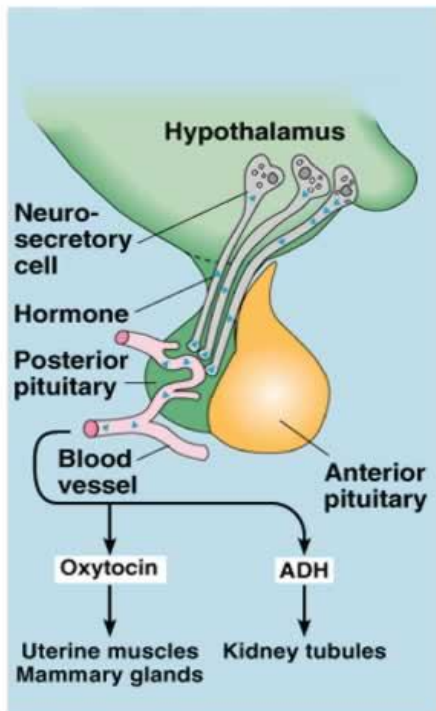


Figure 14:4 Diagram of the negative feedback regulation of the secretions of hormones by the anterior lobe of the pituitary gland.

ملخص لكل ما سبق



The pituitary gland divided into :

A-ANTERIOR PITUITARY GLAND :

- Which secrete the following Hormones: (chemically we have 3 related groups) :

1- TSH

2- FSH

3- LH

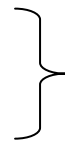
4- GH

5- PROLACTIN

6- ACTH.



Chemically related to each other



Chemically related to each other



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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

Remember : As it mentioned before the Anterior Pituitary gland has 5 types of cells which secrete 6 different hormones

First : PROLACTIN

- **it produced from the cell : Lactotrophs.(15%)**
- **chemical structure : 198 AA.**
- **Related to GH.**

REGULATION OF SECRETION

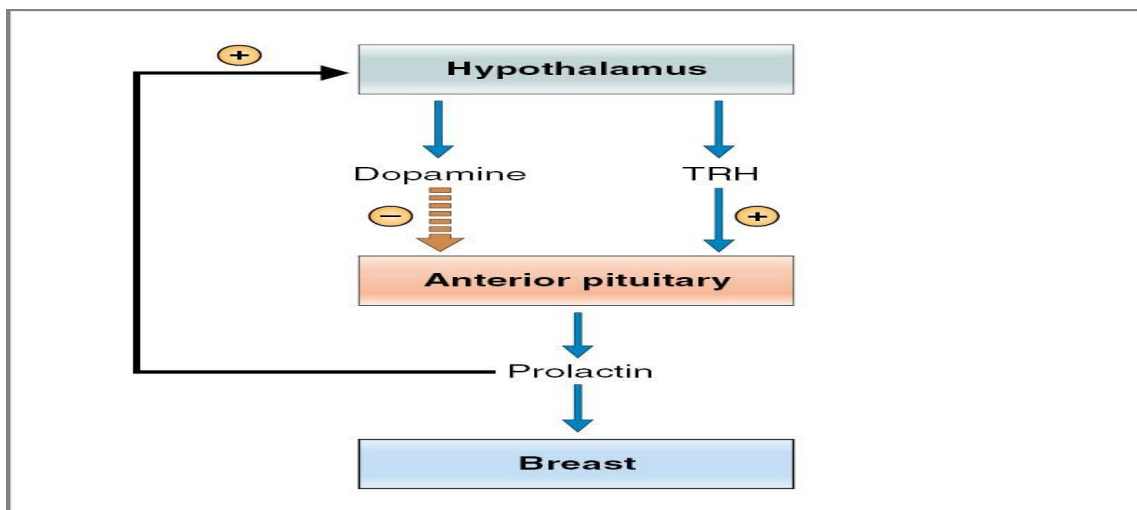
It regulate by 2 main mechanisms :

1- Dopamine (main mechanism) :

Has strong negative effect on production of Prolactin

2- TRH (which is hormone produced from Hypothalamus) :

It has positive effect on production of prolactin (but it is very weak)



SOURCES OF DOPAMINE

- 1- Dopaminergic neurons in the hypothalamus.
- 2- Dopaminergic neurons in the posterior pituitary.
- 3- Nonlactotrophs cells of the anterior pituitary.

Factors affecting prolactin secretion :

1- Stimulatory Factors :

- A- Pregnancy** : during pregnancy the prolactin level increase but it do not show any effect because the Esrogen and progesterone (down regulate) inhibit the prolactine receptors in the breast . (**the prolactin is present but it's not functioning**)
- B- Breast feeding** : the main stimulus – mainly during suckling (**secretion increase about 10 fold**)
- C- Sleep and stress** : because during sleep and stress the TRH level increase
- D-TRH – Dopamine antagonist** : شرحت بالاعلى

2- Inhipitory Factors : انظر الجدول

Note : the prolactin inhibits it's own receptors by increasing the synthesis and secretion of dopamine from hypothalamus .

Table 9-5 Factors Affecting Prolactin Secretion

Stimulatory Factors	Inhibitory Factors
Pregnancy (estrogen)	Dopamine
Breast-feeding	Bromocriptine (dopamine agonist)
Sleep	Somatostatin
Stress	Prolactin (negative feedback)
TRH	
Dopamine antagonists	

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ACTION

- 1- Breast development.
- 2- Lactogenesis. (Lactose, lipid, casein) → start after : Parturition.
- 3- Inhibition of ovulation. By inhibit GnRH

ABNORMALITIES

1- Prolactin deficiency.

It cause : Failure to lactate.

2- Prolactin excess. Cause :

Galactorrhea.

Infertility.

Treatment : Bromocriptine (Dopamine agonist).

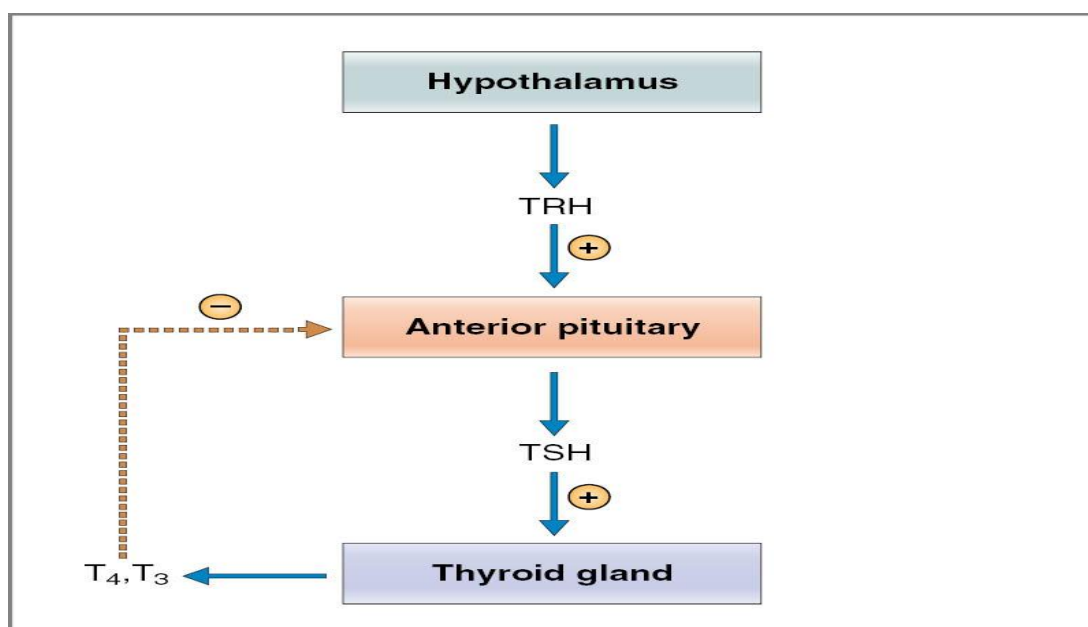
Second : TSH

- **it produced from the cell** : Thyrotrophs.(5%)
- chemical structure : Glycoproteins.
- Has 2 types : α and β .
- Related to FSH and LH.

ABNORMALITIES تفصل لاحقا

- Hyperthyroidism.
- Hypothyroidism.

REGULATION OF SECRETION تفصل لاحقا



ACTION

- 1- Increase synthesis and secretion of thyroid hormones.
- 2- Trophic effect. (**increase the size of gland**)