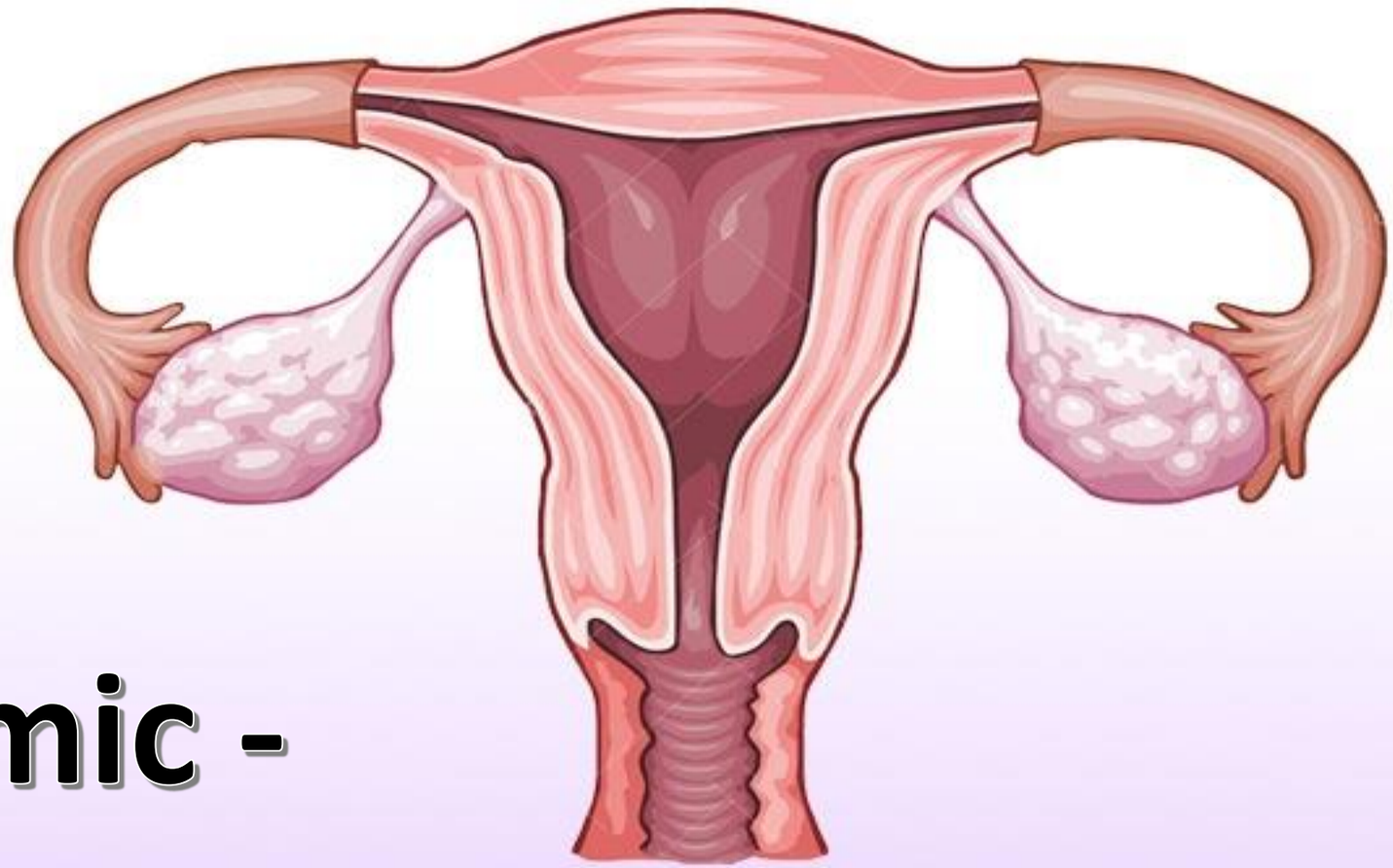
Physiology team



L1- Hypothalamic - Pituitary-Gonadal axis

Sources:

- **males slides**

Objectives

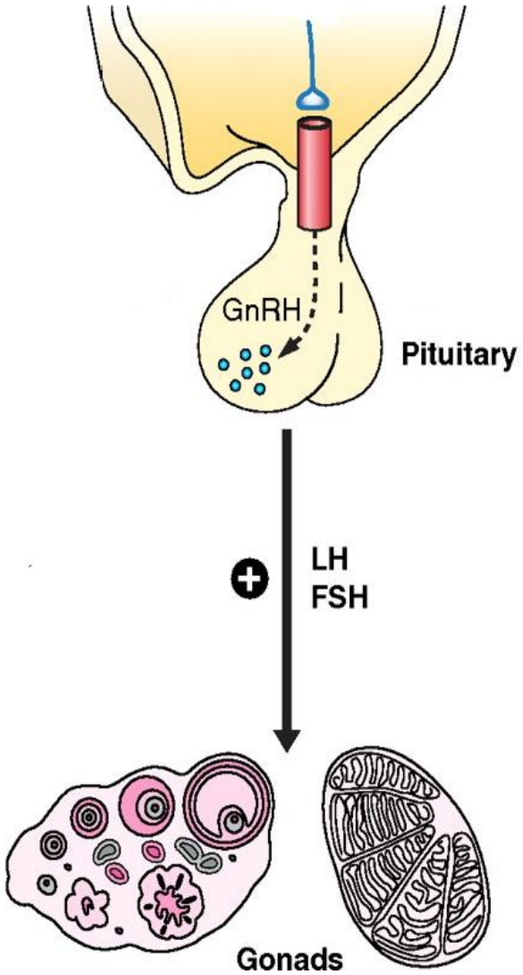
- Describe the regulation of hypothalamic secretion of GnRH and its physiological role on LH & FSH secretion from the anterior pituitary gland.
- Explain the mechanism by which LH & FSH regulate sexual function in males and females.
- Describe the negative and positive feedback mechanisms in the hypothalamic-pituitary-gonadal axis (HPG axis) and their importance in the control of reproductive function

Note : this lecture is kind of introduction to the block , more details will be discussed next lectures

Hypothalamic-Pituitary-Gonadal axis

Hypothalamus

- Secretion of anterior pituitary hormones is controlled by **releasing hormones.**
- releasing hormones formed in the hypothalamus and transported to the anterior pituitary gland by the hypothalamic-hypophyseal portal system.
- **GnRH** released from the Hypothalamus "Medial preoptic nucleus" and activate Gonadotropes in the anterior pituitary gland.



Anterior pituitary

- In response to GnRH , Gonadotropes release both **LH** and **FSH.**
- LH and FSH have different roles in males and females.

GnRH :Gonadotropin-releasing hormone
LH : Luteinizing hormone
FSH : Follicle-stimulating hormone

Hypothalamic-Pituitary-Gonadal axis in males

Hormonal control

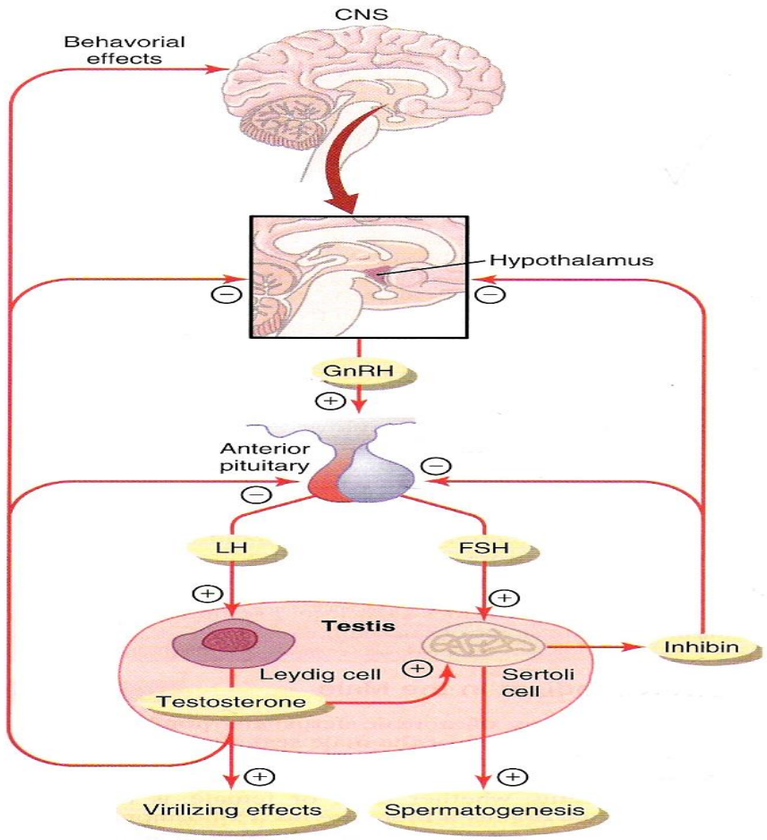
- GnRH is secreted **intermittently** for few minutes every 1 to 3 hrs.
- The secretion of LH by the anterior pituitary is also cyclical following the **pulsatile** release of GnRH
- Conversely , FSH secretion increases and decreases only slightly with each fluctuation of GnRH secretion

LH and testosterone

- LH target **leydig cells** and cause the release of **Testosterone**.
- Testosterone cause both Virilizing effects and help in activation of sertoli cells. and it has an effect in enlargement of prostate gland till the age of .2(
- If the levels of Testosterone increased that will lead to **–ve feedback** and will inhibit mainly **LH** secretion and also GnRH.

FSH

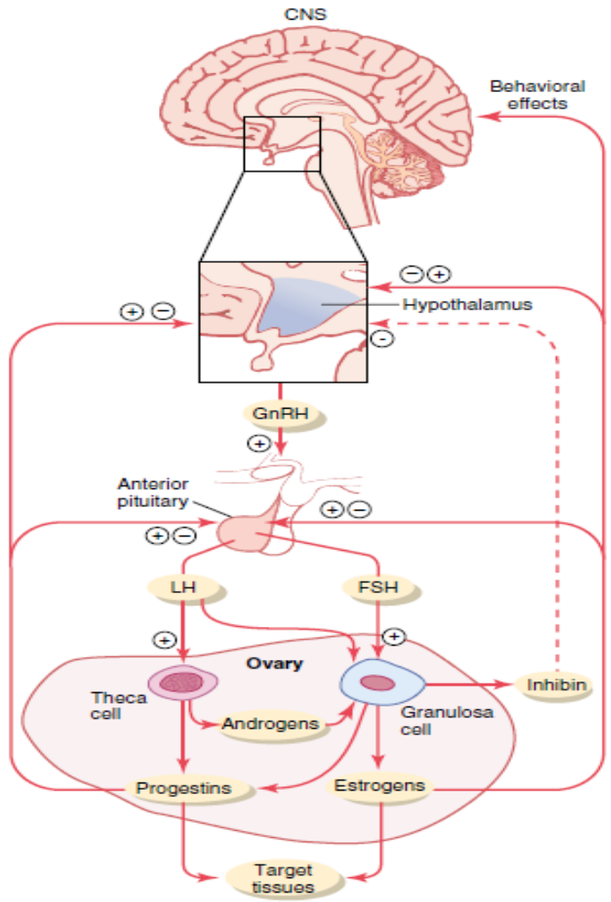
- FSH target **sertoil cells** and will lead to spermatogenesis.
- if there is increased amount of sperms\FSH this will cause a **–ve feedback** causing sertoil cells to secrete **inhibin** which will inhibit mainly **FSH** secretion and also GnRH.



Hypothalamic-Pituitary-Gonadal axis in females

Hormonal control

- Regulation of the **female monthly rhythm**, interplay between the ovarian and hypothalamic-pituitary hormones.
- *Intermittent, pulsatile secretion of GnRH by the hypothalamus stimulates pulsatile release of LH & FSH from the anterior pituitary gland.
- GnRH is secreted in pulses lasting 5 to 25 minutes every 1 to 2 hrs.
- **Negative feedback** effects of estrogen and progesterone cause decreasing both LH and FSH secretion.

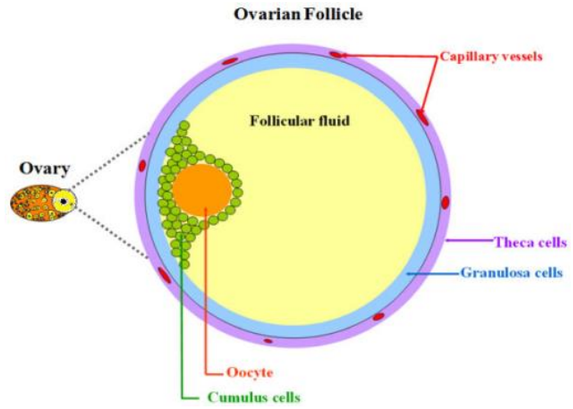


Female Ovarian Follicle

The target organ for LH and FSH in females is the **ovary.**

- 2 types of cells related to hormones " **theca cells** and **granulosa cells**"

- **theca cells :** secrete **androgens** and mainly regulated by **LH**
- **granulosa cells :** convert the androgens that secreted by theca cells to **estrogens** by **aromatase** enzyme , mainly regulated by **FSH**



*continues secretion of GnRH will lead to desensation (down regulation of GnRH receptors → decreases the efficacy of the hormone)

Summary

B. Regulation of testes (Figure 7-17)

1. Hypothalamic control—GnRH

- Arcuate nuclei of the hypothalamus secrete GnRH into the hypothalamic–hypophysial portal blood. GnRH stimulates the anterior pituitary to secrete FSH and LH.

2. Anterior pituitary—FSH and LH

- **FSH acts on the Sertoli cells** to maintain **spermatogenesis.** The Sertoli cells also secrete **inhibin**, which is involved in negative feedback of FSH secretion.
- **LH acts on the Leydig cells** to promote **testosterone synthesis.** Testosterone acts via an intratesticular paracrine mechanism to reinforce the spermatogenic effects of FSH in the Sertoli cells.

3. Negative feedback control—testosterone and inhibin

- **Testosterone inhibits the secretion of LH** by inhibiting the release of GnRH from the hypothalamus and by directly inhibiting the release of LH from the anterior pituitary.
- **Inhibin** (produced by the Sertoli cells) **inhibits the secretion of FSH** from the anterior pituitary.

Summary

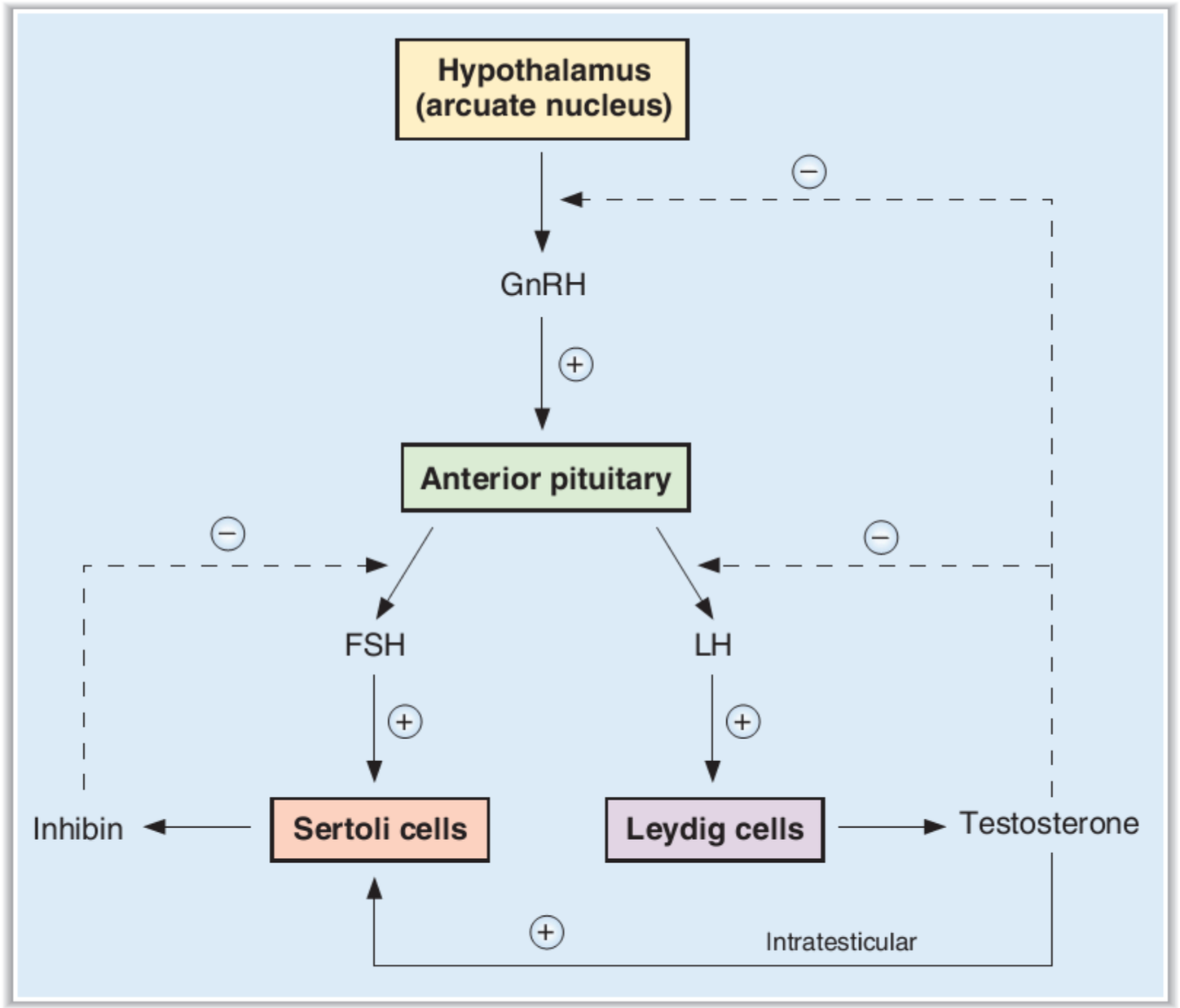


FIGURE 7-17 Control of male reproductive hormones. FSH = follicle-stimulating hormone; GnRH = gonadotropin-releasing hormone; LH = luteinizing hormone.

MCQs

-1Which of the following hormones related to the HPG axis in males:

A-TSH
B-Corticosterone
C-estrogens
D-LH

-2Which of the following hormones related to the HPG axis in females:

A-GnRH
B-ADH
C-ACTH
D-GH

-3Which of the following cells responsible for the secretion of LH and FSH:

A-Somatotropes
B-lactotropes
C-Gonadotropes
D-Corticotropes

-4Which of the following cells is the main target for LH in males:

A-sertoil cells
B-leydig cells
C-theca cells
D-granulosa cells

-5Which of the following cells is the main target for FSH in females:

A-sertoil cells
B-leydig cells
C-theca cells
D-granulosa cells

-6female patient came to your clinic with excess hair and male sex characteristics which of the following might be the cause?

A-tumor in the theca cells
B-deficiency in aromatase enzyme
C-excess TSH secretion
D-A and B

-1D 2- A 3- C 4- B 5- D 6- D

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Reproductive Block