Chapter 15:

Regulation of the Female Sexual Hormones

- ***Document 1:*** *The Sexual Cycle*
- ***Document 2:*** *Cyclic Evolution of the Ovarian Hormones*
- ***Document 3:*** *Hypothalamo-pituitary axis and Ovarian Hormones*
- ***Document 4:*** *Ovarian Feedback Control on the Hypothalamo-Pituitary Axis*
- ***Selected Exercises of the Official Exams***

Document 4:

Ovarian Feedback Control on the Hypothalamo-Pituitary Axis

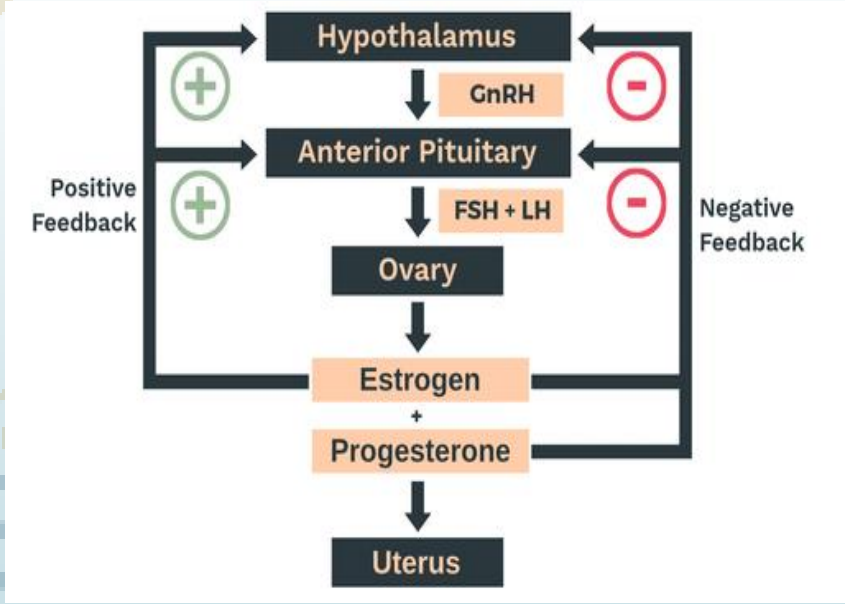
I. Feedback Mechanisms:

- Ovarian hormones exert feedback mechanisms on the hypothalamo- pituitary axis affecting the release of GnRH, FSH and LH.

- **The feedback mechanisms could be either:**

☞ **Positive feedback:** When the increase of estrogen leads to an increase in FSH and LH.

☞ **Negative feedback:** When the increase of estrogen decreases or inhibits the release FSH and LH.



1 Feedback mechanisms: experimental studies

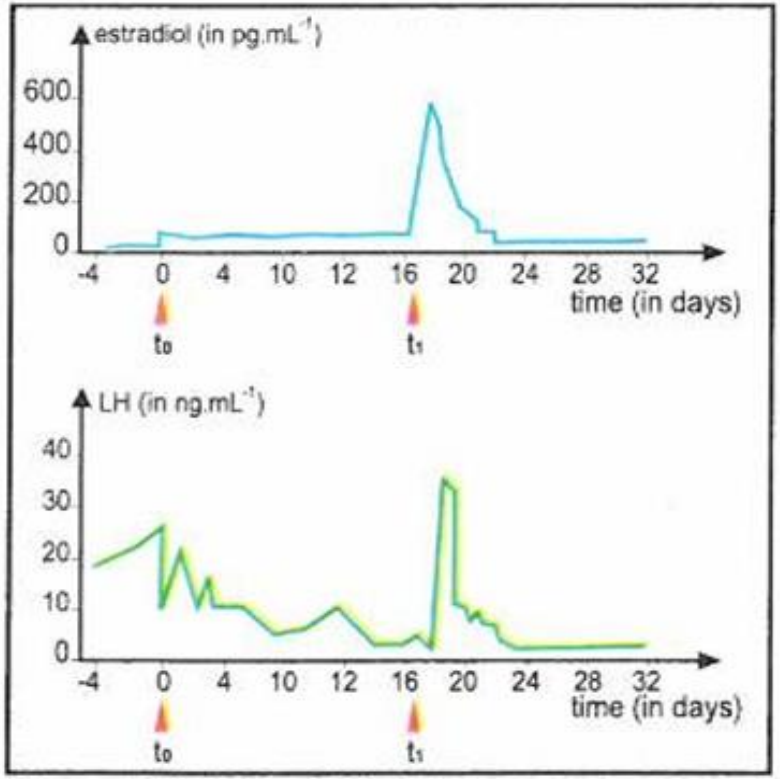
Several experiments carried out on mammals illustrate the effect of ovarian hormones on the secretion of gonadotropic hormones and the release of GnRH.

- In a female rat, a bilateral ovariectomy induces a fall in the blood level of estrogen, as well as an increase in the blood levels of FSH and LH.
- In a female sheep, the injection of estradiol stops, within few hours, the release of GnRH and leads to a decrease in LH level.
- In a female monkey that was subject to ovariectomy, we inject estradiol in the blood:

Starting at a time t_0, the injection is continuous and constant (60 $pg.mL^{-1}$).

When reaching a time t_1, the injection is unique and overdosed (600 $pg.mL^{-1}$).

The results obtained when measuring out the blood levels of LH and estradiol are recorded in ***doc.a***.



Doc.a *Effect of the injection of estradiol on the evolution of LH level in a female monkey.*

- Application 1:

1- Determine the types of feedback control used in each experiment.

In exp 1, because the low amount of estrogen stimulates the secretion of FSH and LH, then there is negative feedback.

In exp 2, because the moderate injection of estrogen inhibits the secretion of FSH and LH, then there is negative feedback.

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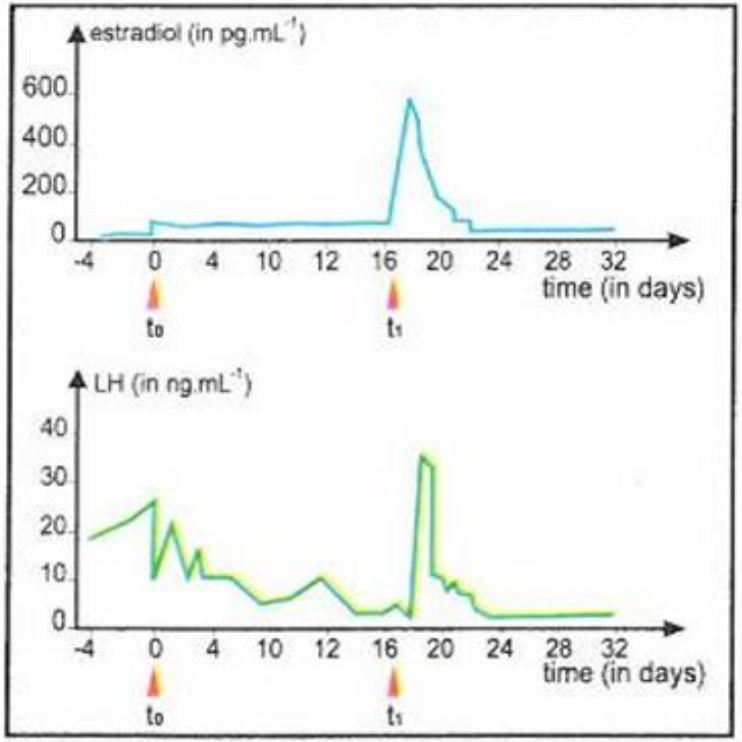


Doc.a *Effect of the injection of estradiol on the evolution of LH level in a female monkey.*

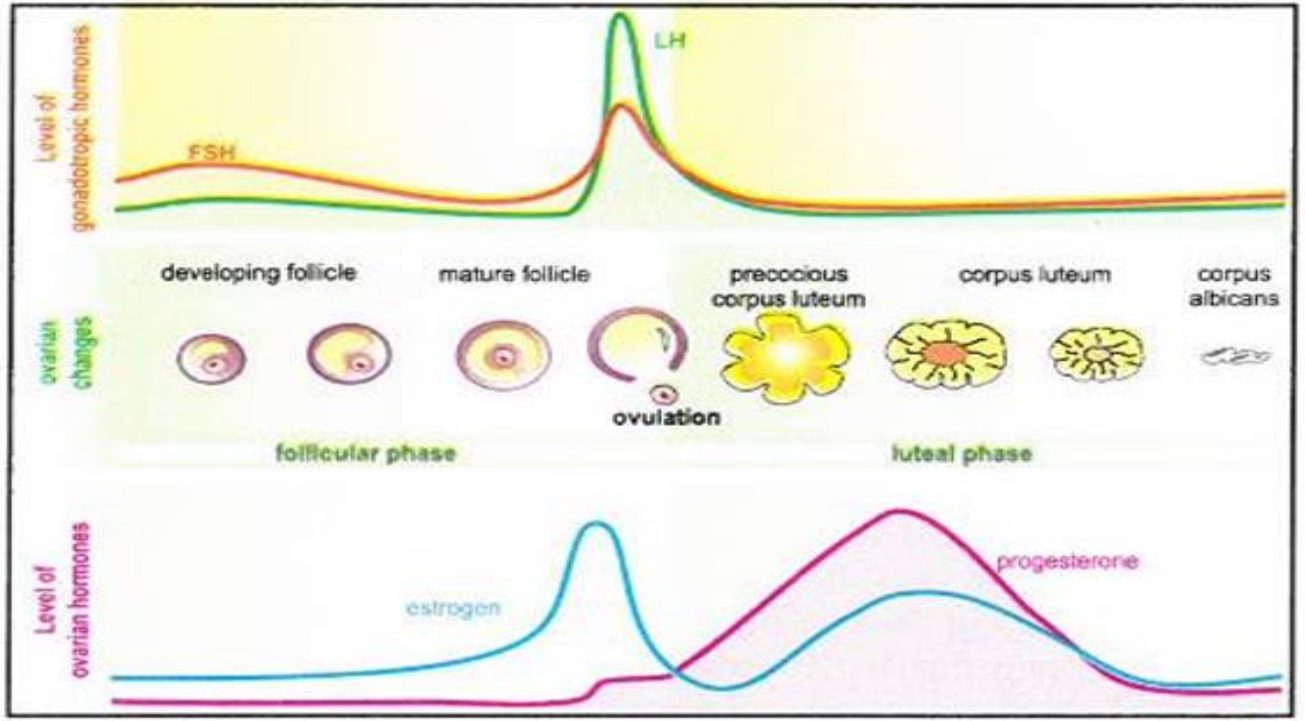
1- Determine the types of feedback control used in each experiment.

In exp 3, between t0 and t1 the low level of estradiol stimulates the release of moderate level of LH then the feedback is negative. While because at t1 the high level of estrogen stimulates the secretion of LH (increases to 35 ng.ml-1) then the feedback is positive.

II. Feedback Mechanisms During the Cycle.

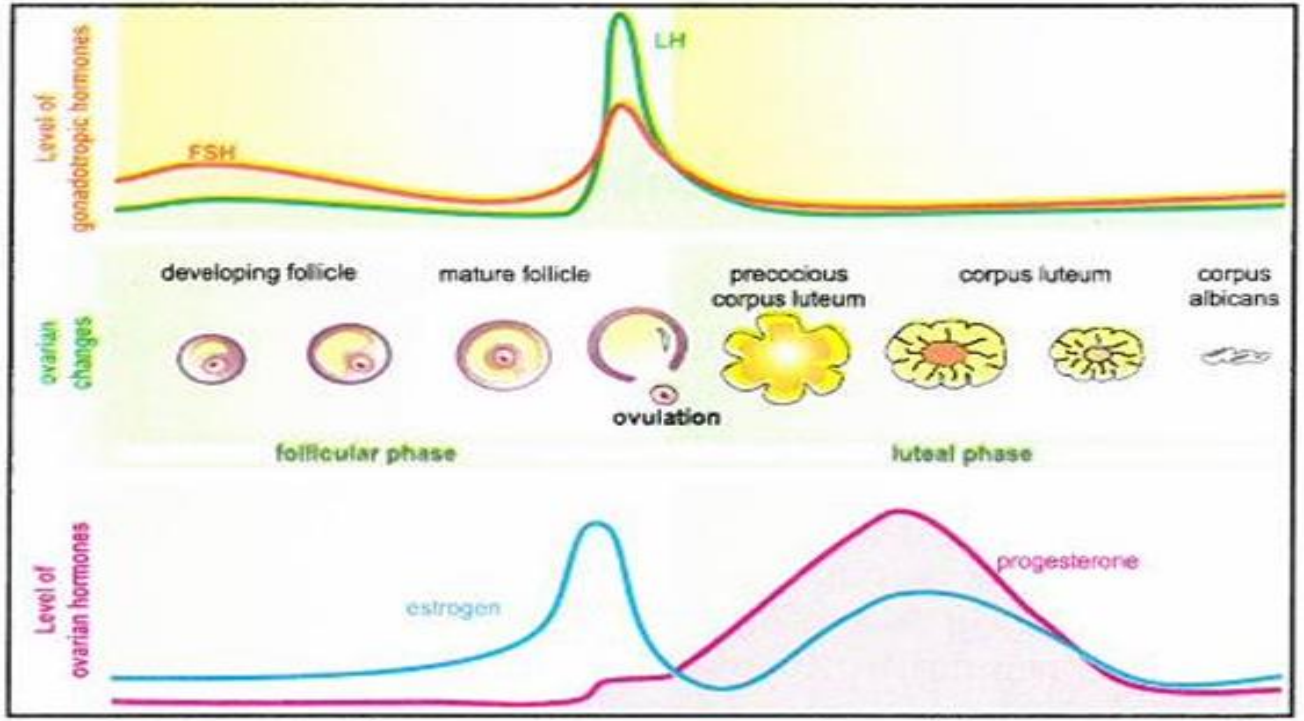
- Document b shows interaction between the ovarian cycle and the pituitary cycle.

- During menses, low amounts of estrogen and progesterone **creates a negative feedback** on the hypothalamo-pituitary axis leading to the secretion of FSH (which stimulates the follicles start to develop) and LH.



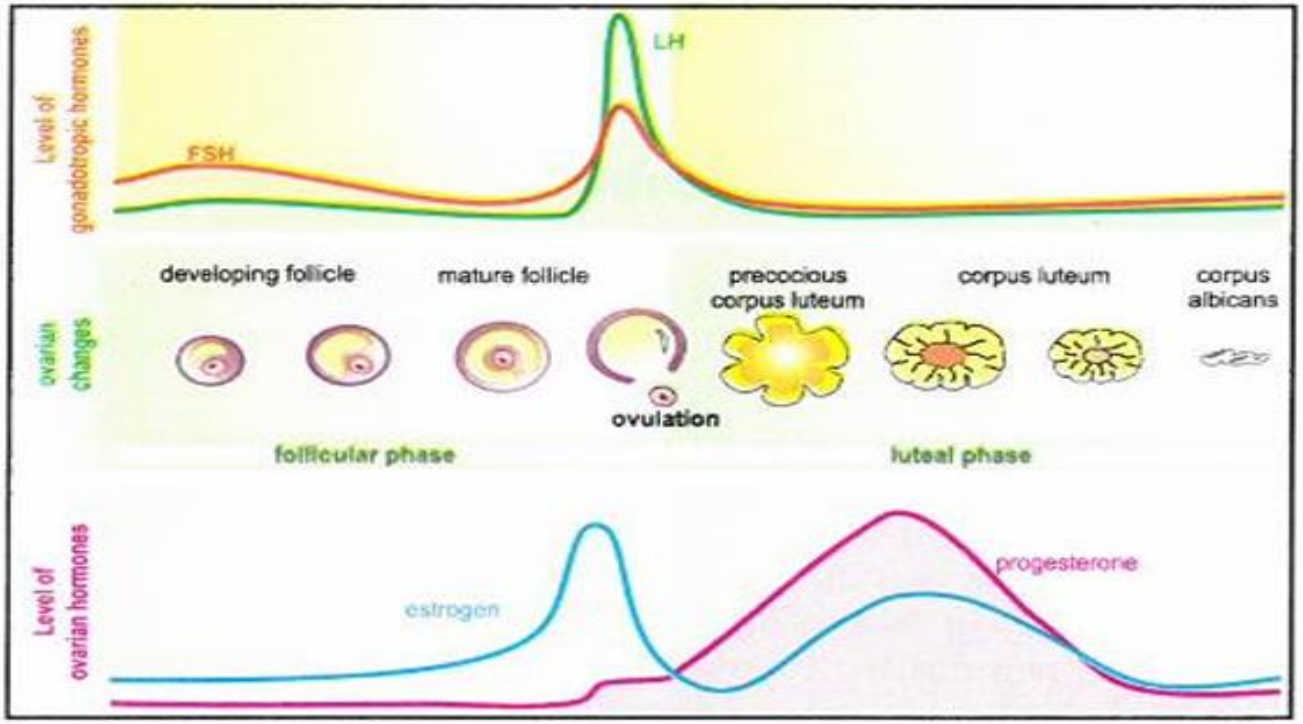
Doc.b *Interaction between the ovarian cycle and the pituitary cycle.*

- During the follicular phase (day 7 to day 14) follicles start to release moderate amount of estrogen, **this exerts negative feedback** on the hypothalamo-pituitary axis leading to a decrease in FSH and LH.



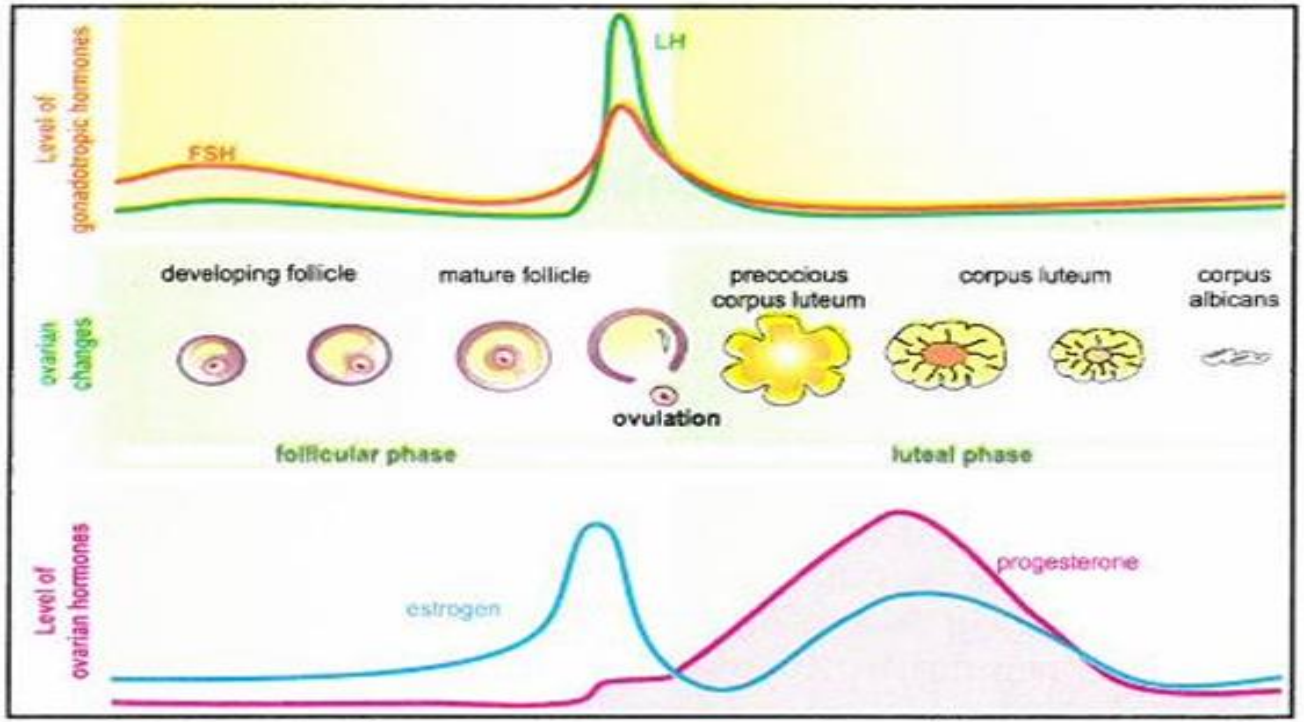
Doc.b *Interaction between the ovarian cycle and the pituitary cycle.*

- On the day of ovulation, the concentration of estrogen released by the Graafian follicle increases sharply, this causes the increase in secretion of LH to reach a peak (surge) that causes ovulation ⇨ **positive feedback.**



Doc.b *Interaction between the ovarian cycle and the pituitary cycle.*

- During the luteal phase (day 14 to day 28 or until 9 months if there is pregnancy), the corpus luteum secretes estrogen and progesterone, **that exert negative feedback** leading to the decrease in the level of LH and FSH to almost null.



Doc.b *Interaction between the ovarian cycle and the pituitary cycle.*

⇨ **Only at day of ovulation there is positive feedback.**

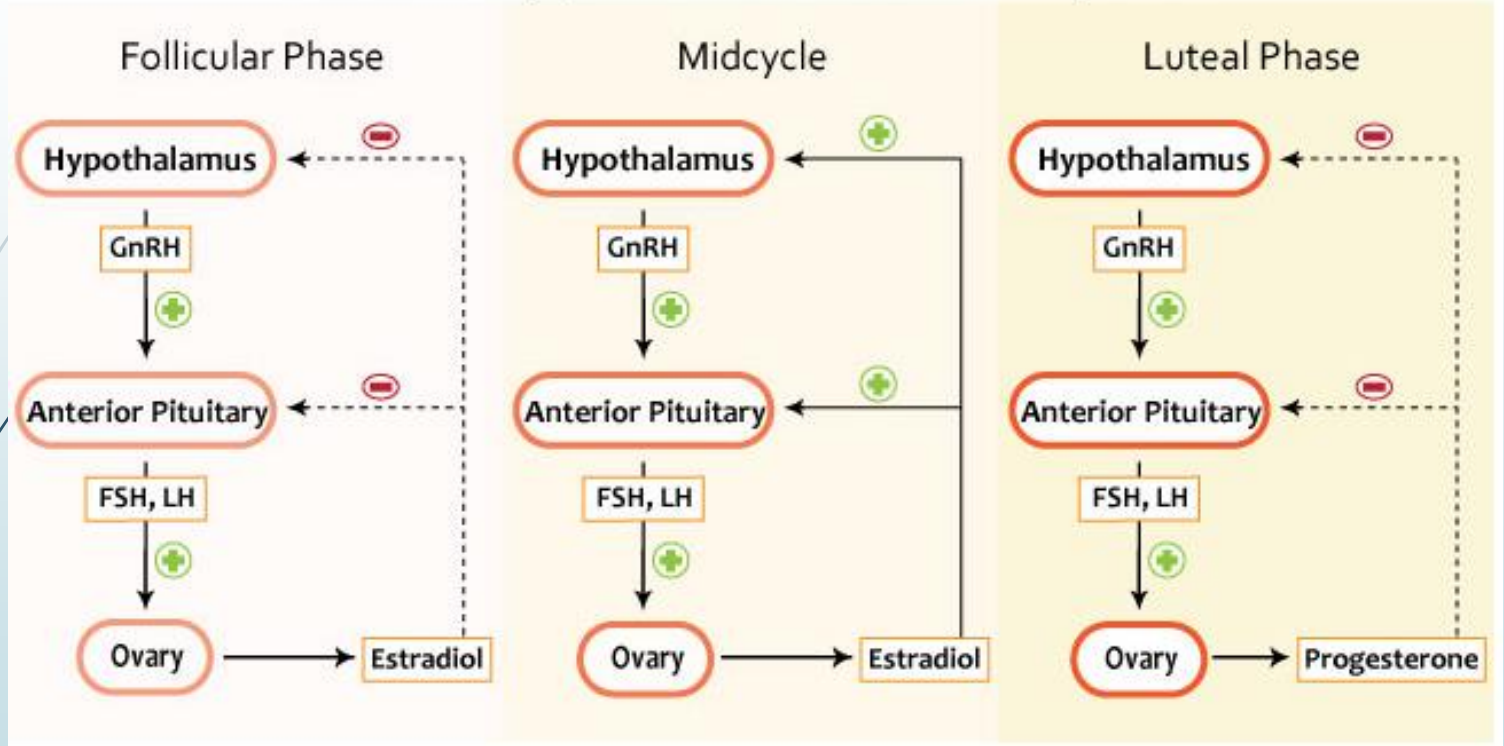
*The decrease in FSH during pregnancy prevents maturation of follicles and ovulation.

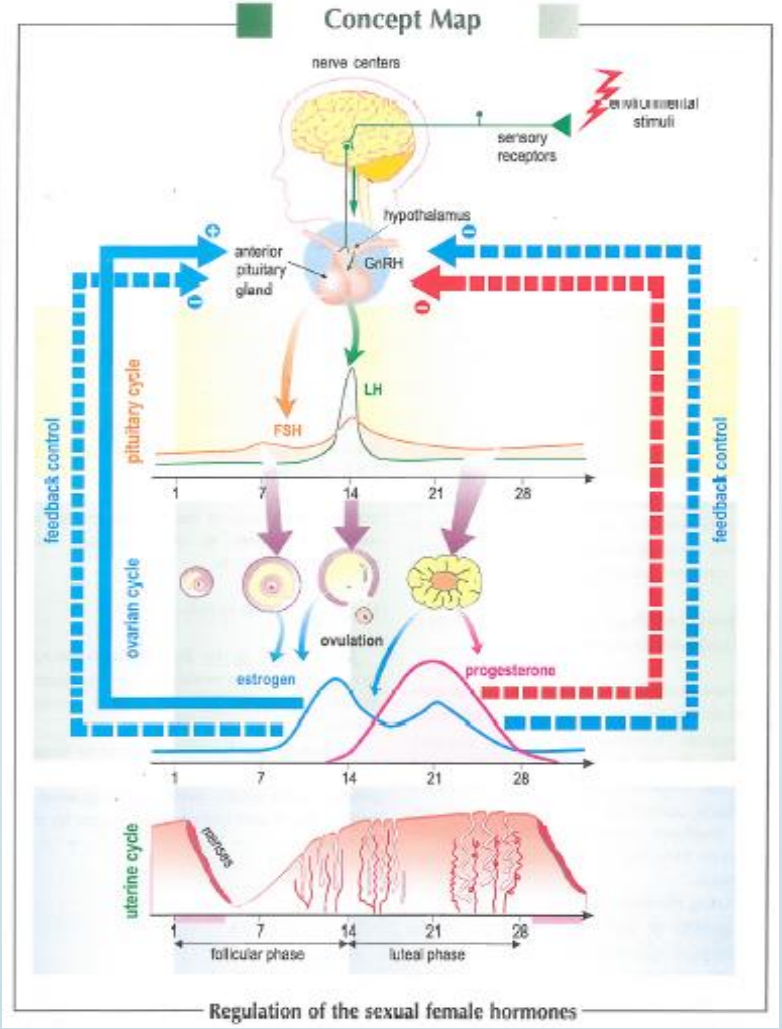
*High progesterone level during pregnancy prevents sloughing off of the endometrium.

Environmental factors

External stimuli, which are perceived by the nervous system at the level of the brain, may stimulate the hypothalamic functions. They also act on the pituitary secretions (and therefore on the sexual cycles).
Thus, strong emotions, fatigue, psychological problems, medicines and others may disturb the cycle and even stop it.

Female Hypothalamus-Pituitary Axis





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