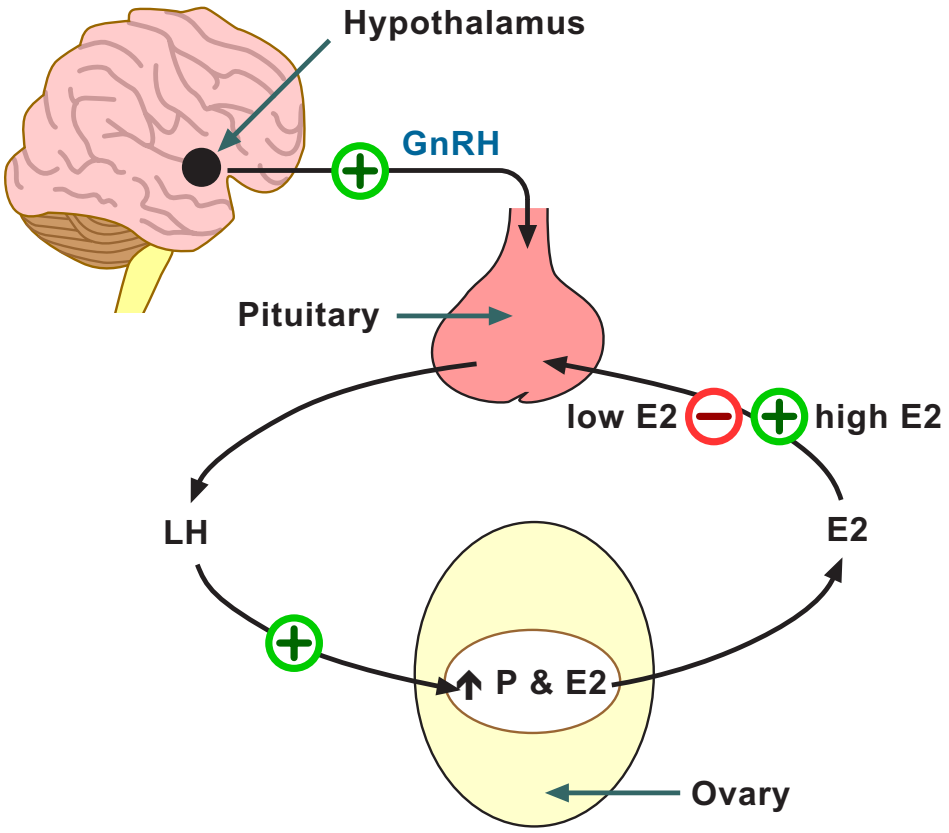
Topic 23: Physiology Overview: The Reproductive System

I. The Female Reproductive System

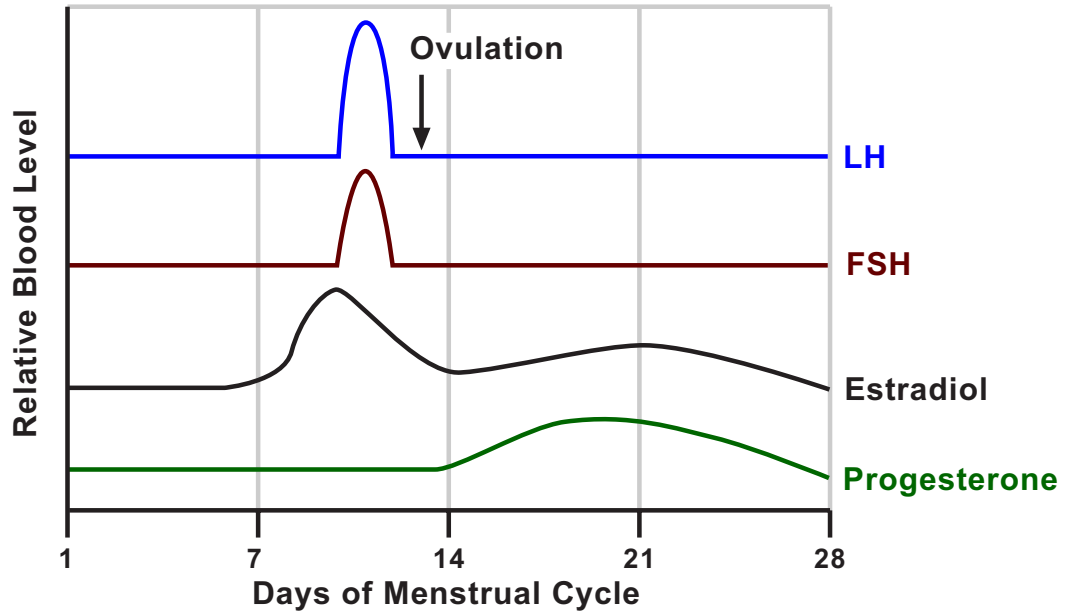
Fig. 23.1 Feedback Control of Ovarian Hormone Production



A. Feedback Control of Ovarian Hormone Production
- The pathway leading to the secretion of female steroid sex hormone begins in the hypothalamus, with secretion of the releasing hormone **GnRH** (gonadotropin-releasing hormone)
- GnRH stimulates the pituitary to release FSH and LH
- FSH and LH stimulate production of sex steroids, **estradiol** – the most common estrogen (E2 in Figure 23.1) and **progesterone** (P in Figure 23.1)
- Negative and positive feedback by estradiol and progesterone controls FSH and LH production:
  - Low levels of E2 and P cause negative feedback to inhibit FSH and LH secretion
  - High levels of E2 and P stimulate FSH and LH secretion

B. The Menstrual Cycle

Figure 23.2 The Menstrual Cycle



1. Follicular phase
   - The menstrual cycle begins as FSH stimulates development of an **ovarian follicle** (an egg surrounded by a covering of cells). As this follicle matures, it begins producing a small but steadily rising amount of estradiol. This low level of estradiol causes:
     - Negative feedback: inhibition of FSH and LH secretion
     - Growth of the lining of the uterus
2. Ovulation
   - The amount of estradiol secreted at mid-cycle has increased to the high level that stimulates a surge of FSH and LH release by the pituitary
   - The LH surge causes **ovulation**: the follicle ruptures and releases its egg near the opening of its fallopian tube
3. Luteal Phase
   - Following the release of its egg, the follicle changes into a hormone-secreting structure, the **corpus luteum**, and secretes estradiol and progesterone in response to LH.
     - Estradiol and progesterone stimulate the continued development of the lining of uterus
   - If pregnancy does not occur, the corpus luteum eventually disintegrates and stops secreting estradiol and progesterone. The uterine lining sheds and menstruation occurs.
   - If pregnancy occurs, the placenta produces **hCG** (human chorionic gonadotropin) which maintains corpus luteum's secretion of progesterone
     - Most pregnancy tests detect the presence of hCG
   - At 3 months gestation, the placenta takes over secretion of progesterone

II. The Male Reproductive System

A. Feedback Control of Testicular Hormone Production

- As in the female reproductive system, GnRH stimulates the pituitary to release FSH and LH
- FSH stimulates the cells of the **seminiferous tubules** to produce sperm.
- LH stimulates the **interstitial cells** of the testes to produce androgens.
  - Androgens also stimulate the production of sperm
- Androgens exert negative feedback on the production of GnRH, FSH, and LH.
- FSH and LH also exert negative feedback on GnRH production.
- In human males, these feedback loops keep androgen levels relatively stable.

Quick Question
Question: What would happen if a woman begins taking a regular, low dose of estradiol at the start of her menstrual cycle (when her own estradiol production is extremely low)?
Answer: Estradiol, at low levels, exerts negative feedback on FSH and LH secretion. If a woman begins taking low doses of estradiol at the start of her cycle, when her own estradiol production is extremely low, the estradiol she has taken will inhibit her body's production of FSH and LH. Therefore, FSH will not stimulate the follicle to grow and release estradiol, and an LH surge will not occur to stimulate ovulation. The estradiol she has taken will stimulate growth of the lining of her uterus, but menstruation will not occur until she stops taking estradiol. What I have described is part of the mechanism of action of oral contraceptives.