



جامعة الأزهر - غزة
AL-AZHAR UNIVERSITY-GAZA



Female reproductive system



FEMALE HORMONAL SYSTEM

- The 28-day period of the female sexual cycle is determined by the time required for the development of the follicles and corpus luteum after menstruation and the feedback effect on the hypothalamus of the hormones they secrete.





MONTHLY OVARIAN CYCLE

- One mature ovum is released from the ovary during each monthly cycle, and the endometrium of the uterus is prepared for implantation of the fertilized ovum at the appropriate time.
- To achieve these results, all of the hormones of the female reproductive system must interact.
- The changes of the blood concentrations of the most important hormones of the system over the course of the 28-day cycle are illustrated in

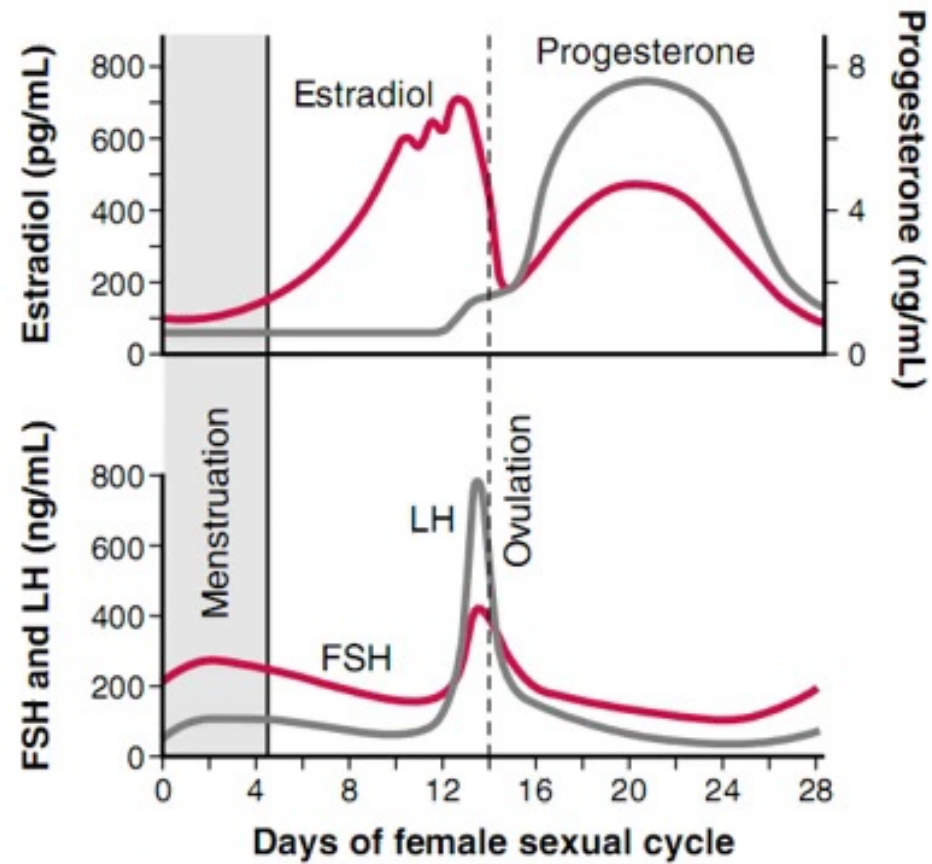


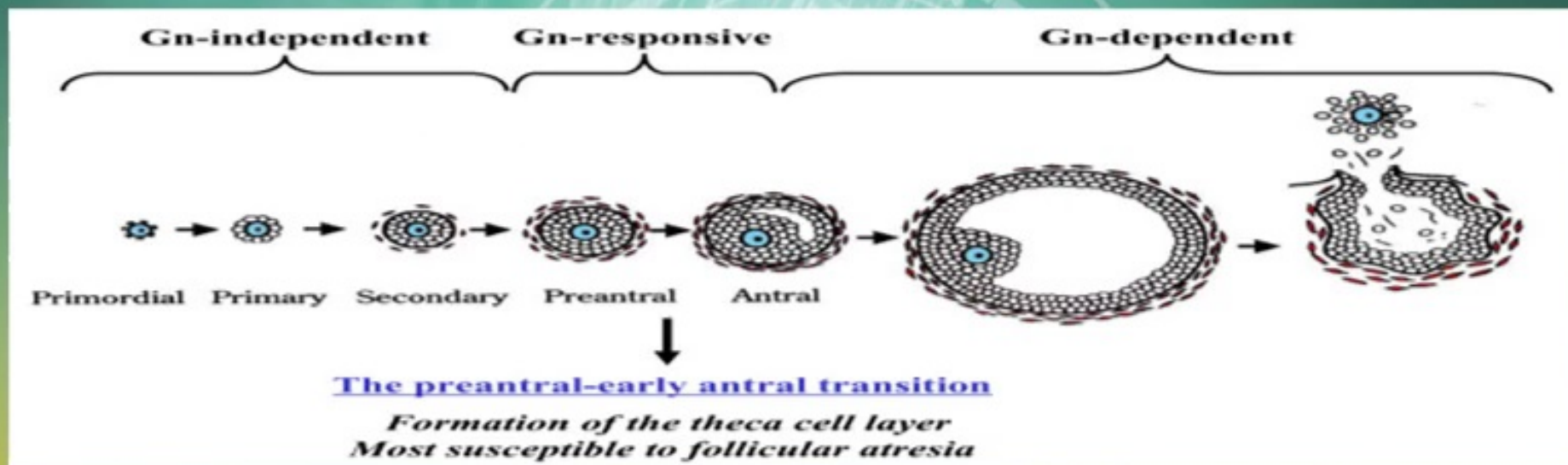
Figure 82-1 Approximate plasma concentrations of the gonadotropins and ovarian hormones during the normal female sexual cycle.

Ovarian Follicle Development—The “Follicular” Phase

- At the beginning of the monthly cycle, no mature follicles or corpus lutea are present.
- At the beginning of the monthly cycle, estrogen and progesterone concentrations in the blood are at their lowest levels.
- As a result, the hypothalamus receives no inhibitory signals to block secretion of GnRH.
- The secreted GnRH stimulates FSH and LH secretion from the pituitary , and the FSH stimulates development of 12 to 14 primary ovarian follicles.



Ovarian Follicle Development—The “Follicular” Phase



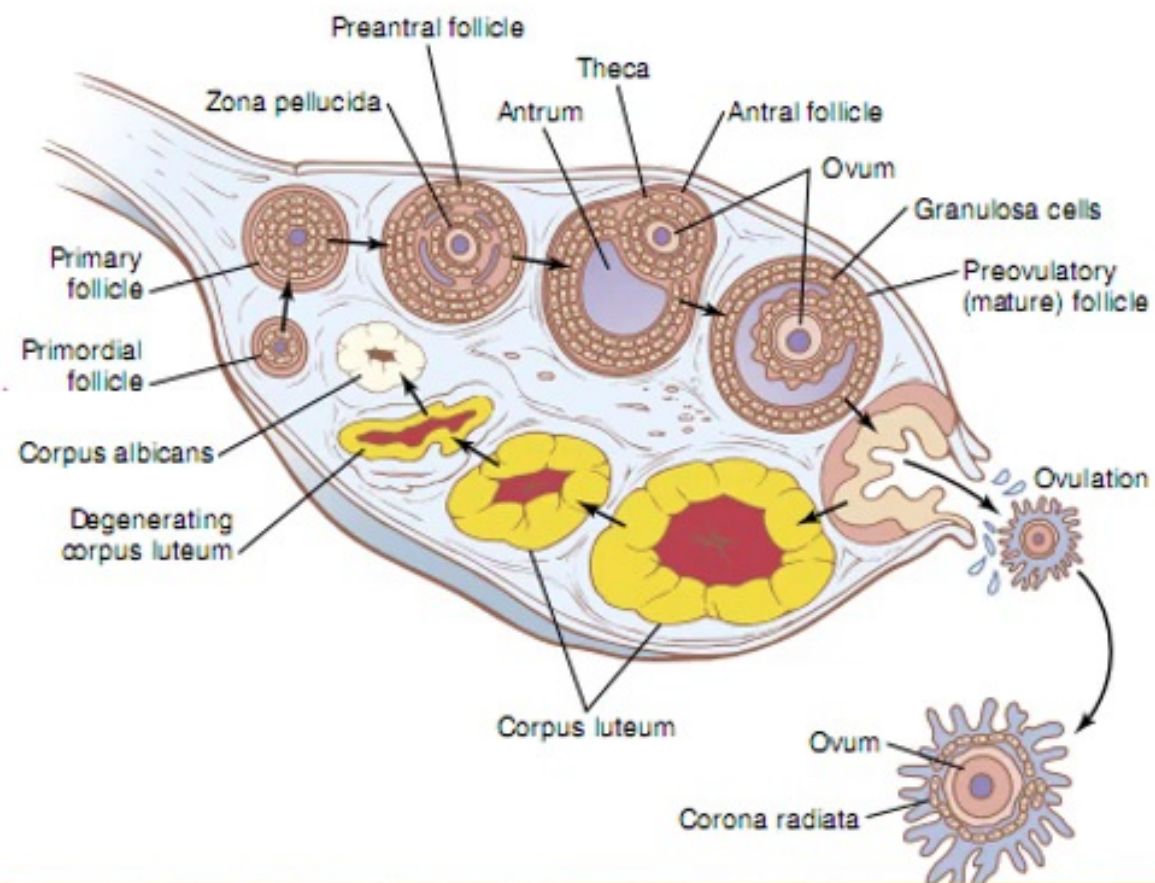
Ovum	Primary follicle	Preamtral follicle	Antral follicle	Vesicular follicle
10-15 follicles Ovum size ↑ 2-3 Granulosa cells proliferation	Zona Pellucida (glycoprotein)	Theca cells Interna (secretory) Externa (Fibrous)	Cavity	Very large cavity

Ovarian Follicle Development—The “Follicular” Phase

- The follicles are surrounded by granulosa cells, which begin to secrete fluid into the center of the structure; this in turn expands to form a fluid-filled antrum that surrounds the oocyte. At this stage, the structure is referred to as an antral follicle.
- The fluid is rich in estrogen, which diffuses into the blood and results in a progressive rise in its concentration.
- The follicles continue to develop, stimulated by FSH, LH, and the estrogen secreted by the follicles.
- Proliferation of the granulosa cells proceeds, accompanied by growth of surrounding layers of thecal cells derived from the stroma of the ovary.
- With accumulation of additional fluid and continued development, the follicle is referred to as a vesicular follicle.

Ovarian Follicle Development—The “Follicular” Phase

- After approximately 1 week of development, one follicle begins to outgrow the others.
- The remaining follicles, which developed to the follicular stage, undergo atresia and degenerate.
- The remaining dominant follicle continues to develop rapidly, with proliferation of granulosa and thecal cells stimulated by FSH and estrogen.
- The estrogen promotes development of additional FSH and LH receptors on the granulosa and thecal cells, which provides a positive feedback cycle for rapid development of the maturing follicle.



Stages of follicular growth
also showing formation of
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Ovarian Follicle Development—The “Follicular” Phase

- Because of the rapidly rising concentration of estrogen in the blood the hypothalamus receives an inhibitory signal to depress GnRH secretion, resulting in suppression of FSH and LH secretion from the pituitary.
- The reduction in FSH secretion prevents the development of additional follicles.
- The dominant follicle continues to develop because of its intrinsic positive feedback cycle, whereas the other vesicular follicles involute, and no additional primary follicles begin to develop.



Ovulation

- Ovulation in a woman who has a normal 28-day female sexual cycle occurs 14 days after the onset of menstruation.
- About 2 days before ovulation, a surge of LH secretion, 6- to 10-fold above normal, occurs. Is LH surge is necessary for ovulation to occur.
- In an action associated with the LH surge, the thecal cells begin to secrete progesterone for the first time.
- The blood flow in the thecal layers increases at this time, as does the rate of transudation of fluid into the vesicle.
- The thecal cells also secrete a proteolytic enzyme into the follicular fluid.



Ovulation

- At a point of weakness in the wall of the follicle on the surface of the ovary, a protrusion, or stigma, develops.
- The wall ruptures at the stigma within 30 minutes of its formation, and within minutes of the rupture, the follicle evaginates and the oocyte and surrounding layers of granulosa cells—referred to as the corona radiata—leave the vesicle and enter the abdominal cavity at the opening to the fallopian tube.

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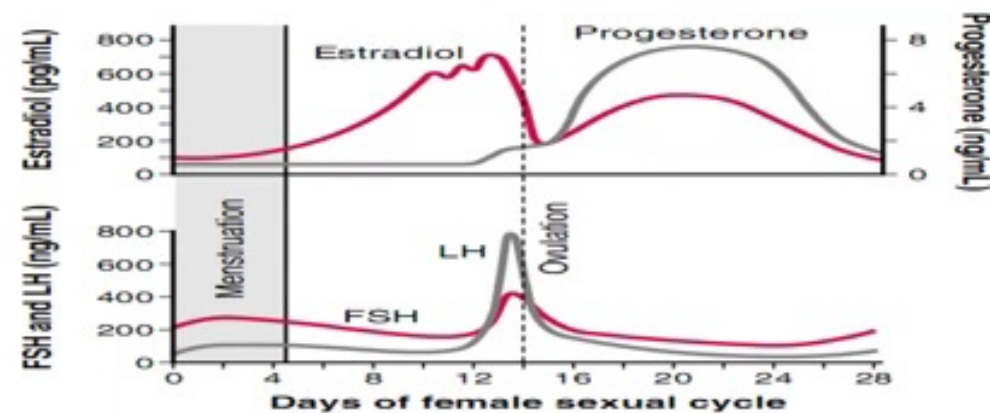


Figure 82-1 Approximate plasma concentrations of the gonadotropins and ovarian hormones during the normal female sexual cycle.

2- Graffian follicle	3- Ovulation	4- Luteal phase
After 1w, 1 follicle is chosen by programmed cell death - Dominant (Graffian) follicle: Androgen → Has ++ FSH receptors, FSH aromatase → Estrogens then Estrogens → -ve FB → ↓ FSH & LH - Other follicles: Androgen → 5α reductase → DHT DHT → ↓ LH receptors Atrophy of other follicles being Gonadotropin dependent	- Cause: LH surge (mainly): 16 hr before ovulation 6-10 folds & FSH surge: Mid cycle 2-3 folds LH → ↑ progesterone & ↓ Estrogens - Mechanism LH & Progesterone: - Stigma is weak by proteolytic enzymes - Cavity p is increased by PGs E & F New blood vessels and VD transudation → Rupture	- Granulosa cells → LH → Lutein cells Theca cells mainly lipid ER blood vessels - CL secretes: 1- Progesterone (primarily) peak 7 days from granulosa Lutein cells Acting: Centrally – FSH & LH Locally – Follicular growth 2- Estrogens from theca lutein cells Active + Progesterone → ? 3- Inhibin – FSH + – LH - Fate → Corpus albicans 10 -14 days of ovulation 2-3 months Pregnancy