

FEMALE REPRODUCTIVE CYCLE

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PHASES OF REPRODUCTIVE CYCLE

1. **Menstruation (Day 1-5)**
The shedding of uterine lining. Levels of estrogen and progesterone are low.
2. **Follicular phase**
The time between the first day of menstruation and ovulation. Estrogen rises as an egg prepares to be released.
3. **Proliferative phase**
After the menstruation, the uterine lining builds back up again.
4. **Ovulation (Day 14)**
The release of the egg from the ovary, mid-cycle. Estrogen peaks just beforehand, and then drops shortly afterwards.
5. **Luteal phase**
The time between ovulation and before the start of menstruation, when the body prepares for a possible pregnancy. Progesterone is produced, peaks, and then drops.
6. **Secretory phase**
The uterine lining produces chemicals that will either help support an early pregnancy or will prepare the lining to break down and shed if pregnancy doesn't occur.



CYCLE	PRE-OVULATION		OVULATION	POST-OVULATION
<i>Ovarian cycle</i>	FOLLICULAR PHASE			LUTEAL PHASE
<i>Uterine cycle</i>	PERIOD	PROLIFERATIVE		SECRETORY

Cycle

HYPOTHALAMUS

Collection of neuronal cell bodies called arcuate nucleus is present in hypothalamus. Neurons present in arcuate nucleus are truly master regulator of female reproductive activity. Pre-optic nucleus (collection of neuronal cell bodies) help the arcuate nucleus in regulating female reproductive system.

The neurons in arcuate nucleus release special type of chemical substance called gonadotropin releasing factor.

Between hypothalamus and pituitary there is a vascular connection. When gonadotropin releasing factor reach certain cells in anterior pituitary, they stimulate the release of gonadotropins i-e FSH and LH.

REPRODUCTIVE CYCLE

Average reproductive cycle – 28 days

Normal range: 21 to 35 days

Oligomenorrhea- less than 21 days

Polymenorrhea- longer than 35 days

First day of menstrual bleeding is considered first day of reproductive cycle

MENSTRUATION PHASE (DAY 1 to 5)

GnRH released from anterior pituitary in turn releases FSH. FSH converts primary follicle into secondary follicle.

Maximum normal days for menstrual bleeding = 8 days

Minimum normal days for menstrual bleeding = 20-80 mL

PRIMORDIAL FOLLICLES

Primordial follicles are present in ovary. They have one ovum surrounded by epithelial flattened cells. Each month some primordial follicles (almost 15 in number) are matured into primary follicles.

CONVERSION OF PRIMORDIAL FOLLICLE TO PRIMARY FOLLICLE:

The epithelial cells are primordial follicle enlarge, become cuboidal and forms one or more layer around the ovum. These epithelial cells provide nourishment to the ovum.

FROM PRIMARY FOLLICLE TO SECONDARY FOLLICLE

FSH convert primary follicle into secondary follicle. The follicle cells begin to secrete zona pellucida.

(as soon as one sperm passes through the zona pellucida and touch the ovum, zona pellucida become resistant to the rest of the sperms)

STRUCTURE OF SECONDARY FOLLICLE

Innermost ovum is surrounded by zona pellucida surrounded by granulosa cells and an outermost layer of theca cells. The theca layers include theca interna and theca externa.

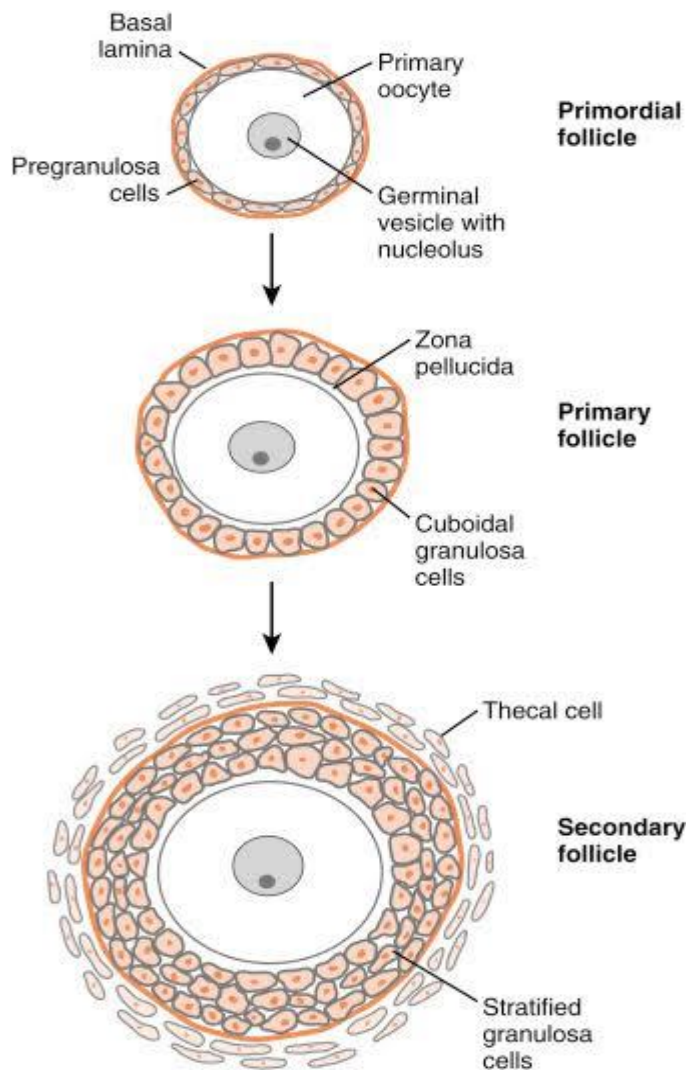
Theca cells produce androgens which move to the granulosa cells which converts these androgens into estrogens. The estrogen moves towards endometrium of uterus and forces the endometrium to undergo proliferation.

Estrogen also move towards anterior pituitary and reduce the level of FSH by negative feedback. As the level of FSH goes down, the follicles other than graafian follicles degenerate as those follicles were dependent on FSH. The degenerated follicles are called atretic follicles.

Under the influence of estrogen the mucus plug in the cervix becomes thin and stringy.

Eventually all the cells surrounding ovum secretes lots of fluid due to which a fluid-filled cavity is created. Such a follicle is called secondary follicle or graafian follicle.

At some point later in the cycle, estrogen moves towards anterior pituitary and increase the level of FSH and LH through positive feedback causing LH hormone surge (LH increases dramatically)



LH FUNCTIONS

1. Cause Blood vessels going towards theca cells (i-e ovum) to dilate

2. Cause Theca cells to release destructive enzymes such as proteolytic enzymes which are digestive enzymes
3. Cause stigma to develop over the graafian follicle.

OVULATION

Ovulation occurs 14 days before next period.

FOLLICULAR STIGMA

Stigma refers to the area of the ovarian surface where the Graafian follicle will burst during ovulation and release the ovum. As the follicle matures, the area between the follicle and the ovarian surface begins to thin and weaken under the influence of the luteinizing hormone and local cytokines. At ovulation the stigma ruptures and the secondary oocyte is released along with zona pellucida and the surrounding granulosa cells, from the region of the follicular fluid. The granulosa cells re-arrange themselves around zona pellucida and these re-arranged cells are now called corona radiata. The secondary oocyte needs to be captured by the fallopian tube where it could be fertilized by a sperm cell. The stigma will heal and the residual follicle is transformed into the corpus luteum.

CORPUS LUTEUM

The ruptured graafian follicle swell up and the number of SER increase inside the follicle due to which fat-globules (cholesterol-rich globules) accumulate. The ruptured follicle start producing the steroid hormone progesterone and this whole body is called corpus luteum. The average life of corpus luteum is 10-12 days.

Under the influence of progesterone from corpus luteum, the following changes take place:

1. The arteries in the endometrium becomes coiled and blood flow to endometrium increase which provide nutrition to endometrium
2. Progesterone thickens the endometrium further
3. Glands become coiled as well

When sperm doesnot penetrate the egg, the corpus luteum degenerates into corpus albicans after 10-12 days. Due to this degeneration, progesterone level goes down and the endometrium becomes ischemic. Endometrium loses its functional layer but doesnot lose its basal layer. The endometrial lining breaks and the blood vessels start bleeding out due to which female experience menstrual bleeding.

When sperm penetrates the egg, the endometrium release human chorionic gonadotrophin (hCG) and signals the corpus luteum to enlarge and keep producing progesterone. The pregnancy test becomes positive due to presence of hCG. (hCG moves to CNS and makes the female nauseous)

As the placenta develops, the embryo receives estrogen and progesterone from the placenta and so later the corpus luteum degenerate after working for about 3-4 months.