The First Week of Development: Ovulation to Implantation

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- *Ovarian Cycle*
- ***Hormonal control of ovarian cycle*** *FSH, Estrogen, LH,*
- Ovulation ,
- *Corpus Atreticum , CORPUS LUTEUM, Corpus Luteum Graviditatis (of pregnancy)*

Ovarian Cycle

- Normal monthly changes that occur in the ovaries which are required for maturation and release of the oocyt.
- At puberty; non pregnant females experience a cyclical sequence of changes in their ovaries and uterus.
- Each cycle takes about one month and involves both oogenesis and preparation of the uterus to receive a fertilized ovum.

Ovarian Cycle

Hormonal control of ovarian cycle :

The hypothalamus:

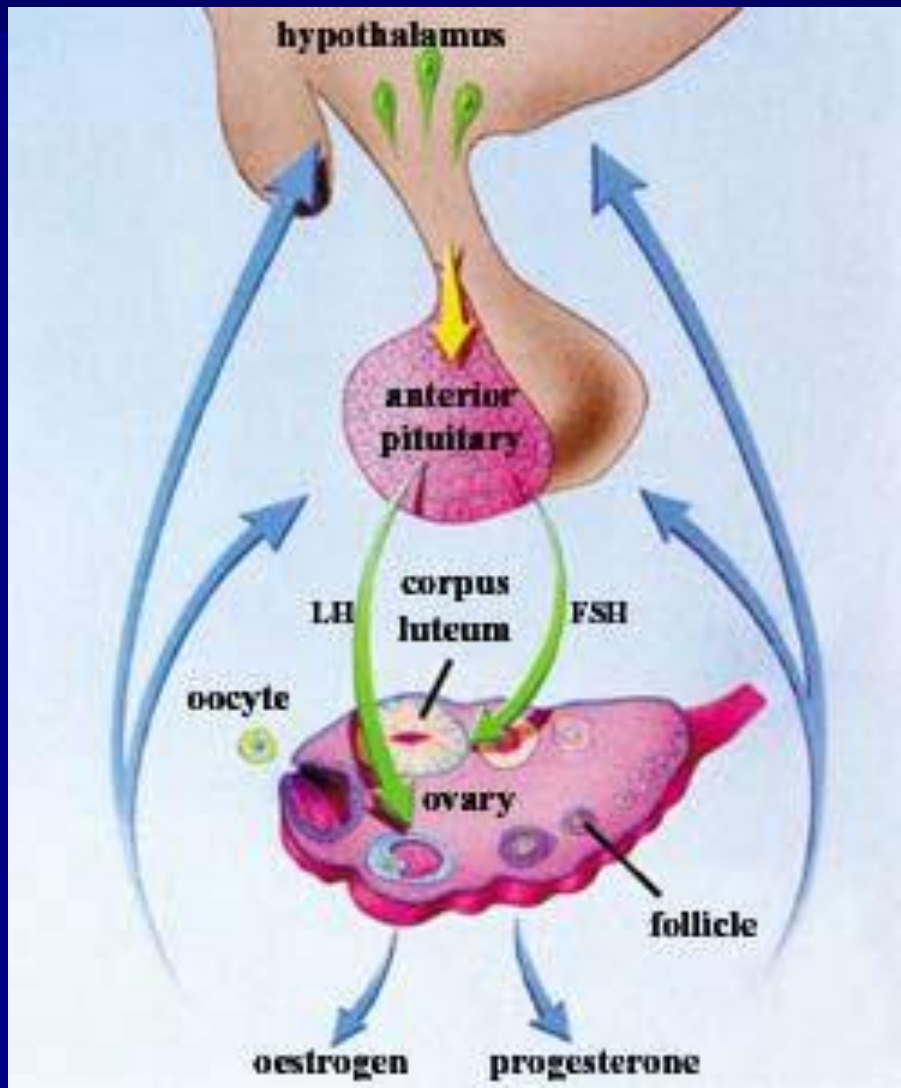
Gonadotropin-releasing hormone (GnRH)

The anterior pituitary gland:

Gonadotropins

(FSH) and (LH)

Stimulate and control cyclic changes in the ovary.



Ovulation

- At the beginning of each ovarian cycle, 15 to 20 primary (preantral) stage follicles are stimulated to grow under the influence of FSH. (The hormone is not necessary to promote development of primordial follicles to the primary follicle stage, but without it, these primary follicles die and become atretic.)
- FSH rescues 15 to 20 of these cells from a pool of continuously forming primary follicles

Ovulation

- **corpus atreticum**
- the oocyte and surrounding follicular cells degenerate and are replaced by connective tissue, forming a **corpus atreticum. FSH also stimulates** maturation of **follicular (granulosa) cells surrounding the oocyte**

Hormonal control of ovarian cycle (FSH)

- The FSH induces the beginning of follicular maturation that is mediated by called-growth differentiation factor-9 (GDF-9)

  (a member of transforming growth factor-β (TGF–B) family.
- The granulose and theca interna cells of the growing follicles secrete estrogens

- (*a) cause the* uterine endometrium to enter the follicular or **proliferative phase;**
- **(*b) cause*** thinning of the cervical mucus to allow passage of sperm; and
- (*c) stimulate the* pituitary gland to secrete LH. At mid-cycle, there is an **LH surge that**
- **(*a) elevates*** concentrations of maturation-promoting factor, causing oocytes to complete meiosis I and initiate meiosis II;
- (*b) stimulates production of progesterone* by follicular stromal cells **(luteinization); and**
- **(*c) causes follicular rupture and*** ovulation.

Hormonal control of ovarian cycle (Estrogen)

Estrogen will results in:

1. proliferative changes of uterine mucosa (the endometrium) to prepare the uterus for implantation of the embryo.
2. thining of the mucus in the cervix of the uterus to allow passage of sperms.
3. stimulation of the pituitary to secret LH, in addition to the hypothalamic stimulation.

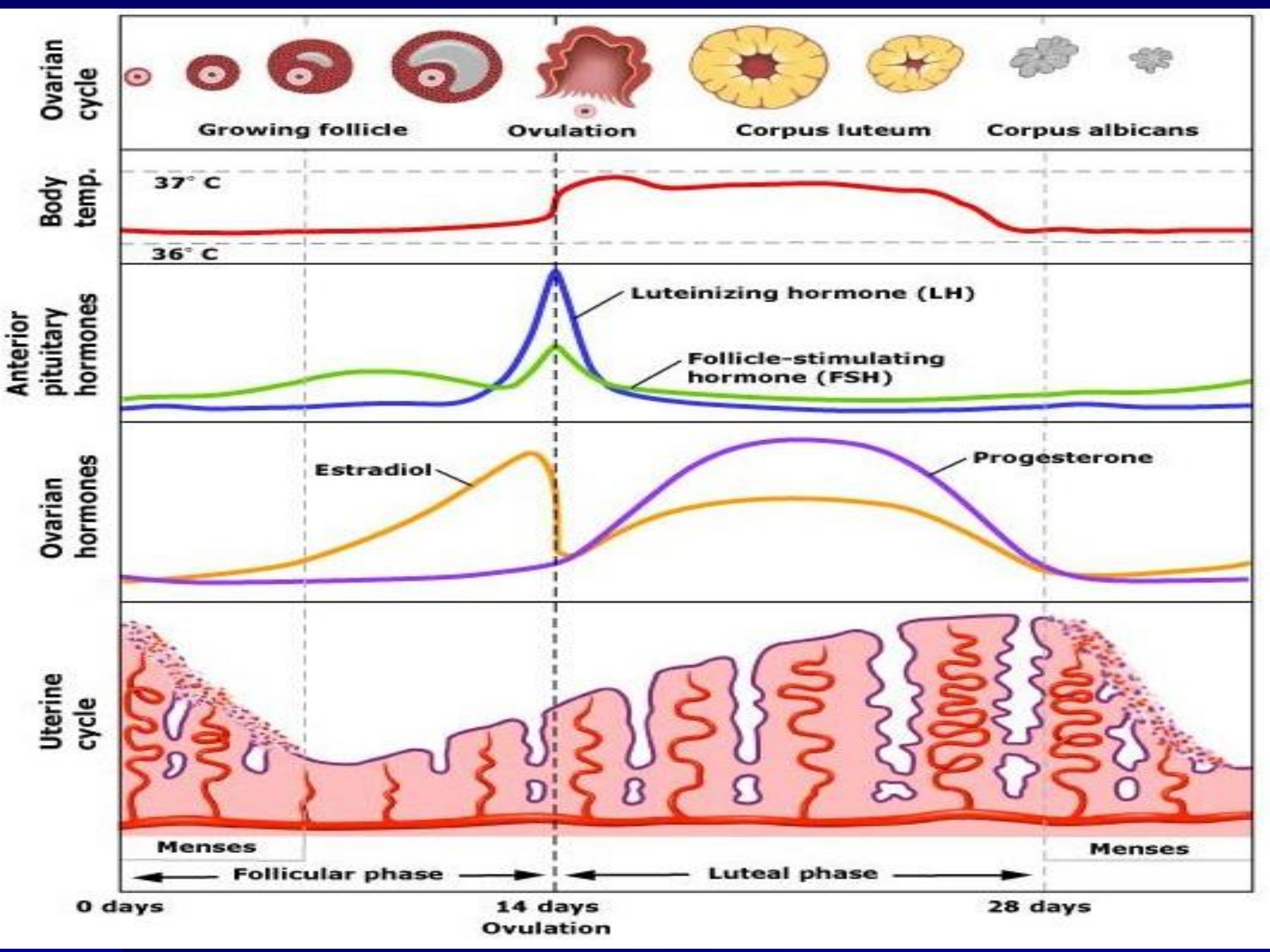
Hormonal control of ovarian cycle (LH)

At the middle of the ovarian cycle, there is an LH surge that will cause:

1. increased maturation-promoting factor that causes completion of meiosis I and beginning of meiosis II.
2. production of progesterone by the follicular and theca interna cells that are transformed into the corpus luteum after ovulation (luteinization)

Hormonal control of ovarian cycle (LH)

3. The LH increases collagenase digestion activity around the follicle
4. Also it increases prostaglandins that causes muscular contraction of the ovarian wall resulting in follicular rupture and ovulation of the oocyte


Ovarian cycle
Growing follicle
Ovulation
Corpus luteum
Corpus albicans
Body temp.
37° C
36° C
Anterior pituitary hormones
Luteinizing hormone (LH)
Follicle-stimulating hormone (FSH)
Ovarian hormones
Estradiol
Progesterone
Uterine cycle
Menses
Menses
Follicular phase
Luteal phase
0 days
14 days
Ovulation
28 days

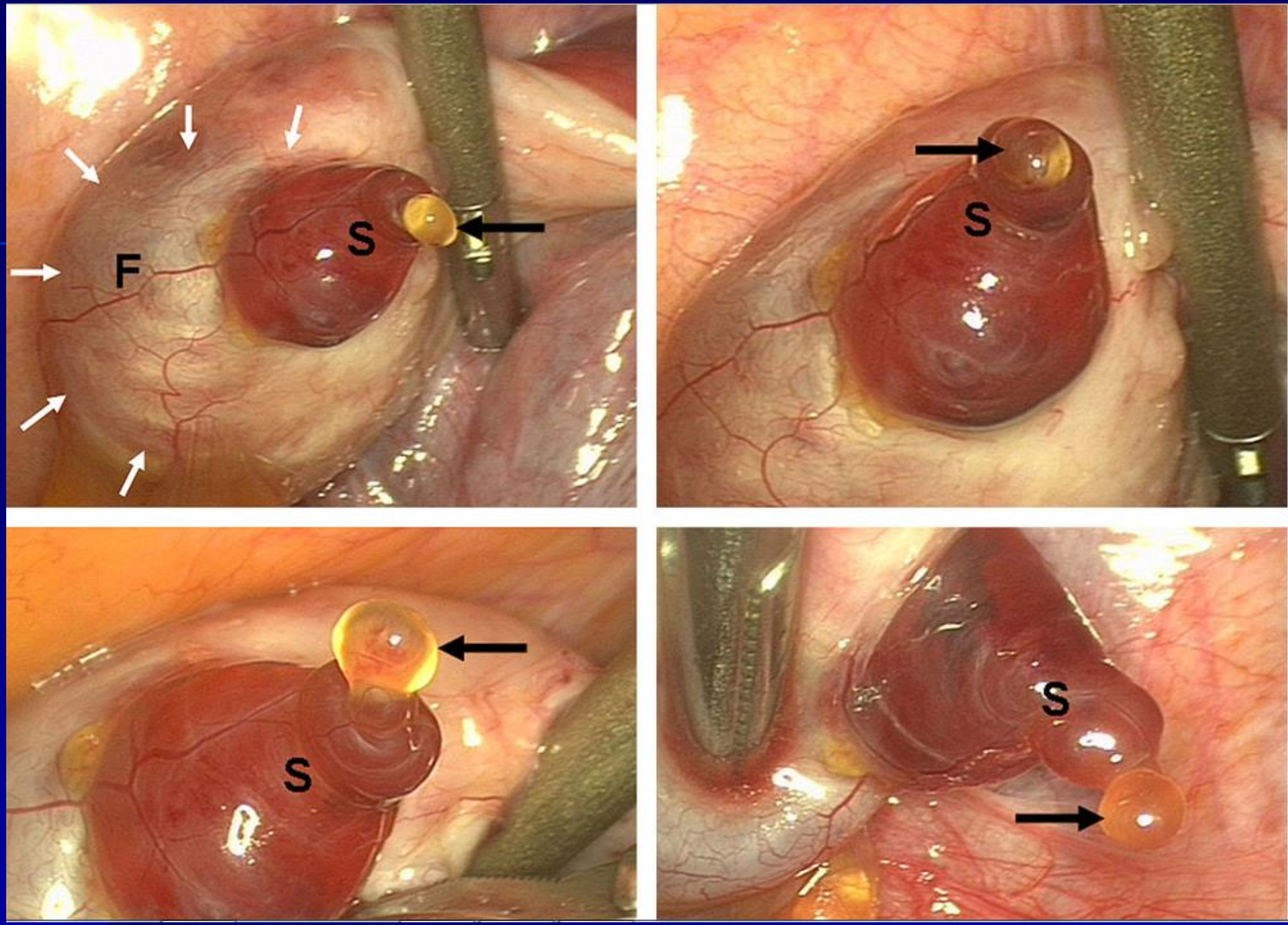
OVULATION

- Under the influence of FSH and LH, the secondary follicle grows rapidly to a diameter of 25 mm
- an abrupt increase in LH that causes the primary oocyte to complete meiosis I and the follicle to enter the preovulatory stage.(mat prom factor)
- Meiosis II is also initiated, but the oocyte is arrested in metaphase approximately 3 hours before ovulation.

OVULATION

- The surface of the ovary begins to bulge locally, and at the apex, an avascular spot, the ***stigma,*** appears
- The high concentration of LH increases:
  -collagenase activity so digestion of collagen fibers surrounding the follicle.
  -Prostaglandin levels → local muscular contractions in the ovarian wall

  → extrude the oocyte with its cumulus oophorus(which then be corona radiata)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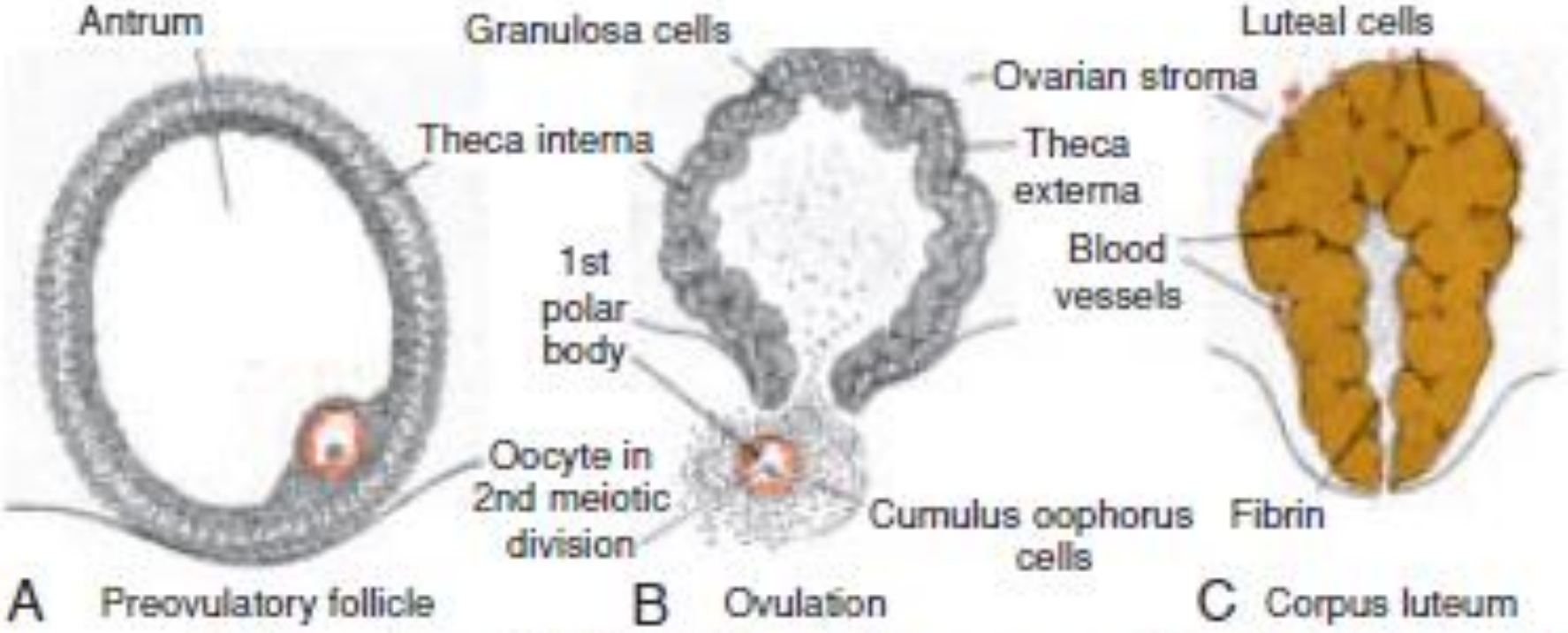


A. Preovulatory follicle bulging at the ovarian surface. **B.** Ovulation. The oocyte, in metaphase of meiosis II, is discharged from the ovary together with a large number of cumulus oophorus cells. Follicular cells remaining inside the collapsed follicle differentiate into lutean cells. **C.** Corpus luteum. Note the large size of the corpus luteum, caused by hypertrophy and accumulation of lipid in granulosa and theca interna cells. The remaining cavity of the follicle is filled with fibrin.

OVULATION

Clinical Features of Ovulation:

1. Slight abdominal pain, known as middle pain
2. rise in basal temperature, which can be monitored to aid in determining when the release of oocyte occurs.

- In cooperation, granulosa and thecal cells produce estrogens that (*a) cause the* uterine endometrium to enter the follicular or **proliferative phase;**
- **(*b) cause*** thinning of the cervical mucus to allow passage of sperm; and
- (*c) stimulate the* pituitary gland to secrete LH. At mid-cycle, there is an **LH surge that**
- **(*a) elevates*** concentrations of maturation-promoting factor, causing oocytes to complete meiosis I and initiate meiosis II; (*b) stimulates production of progesterone*
- by follicular stromal cells **(luteinization); and (*c) causes follicular rupture and*** ovulation.

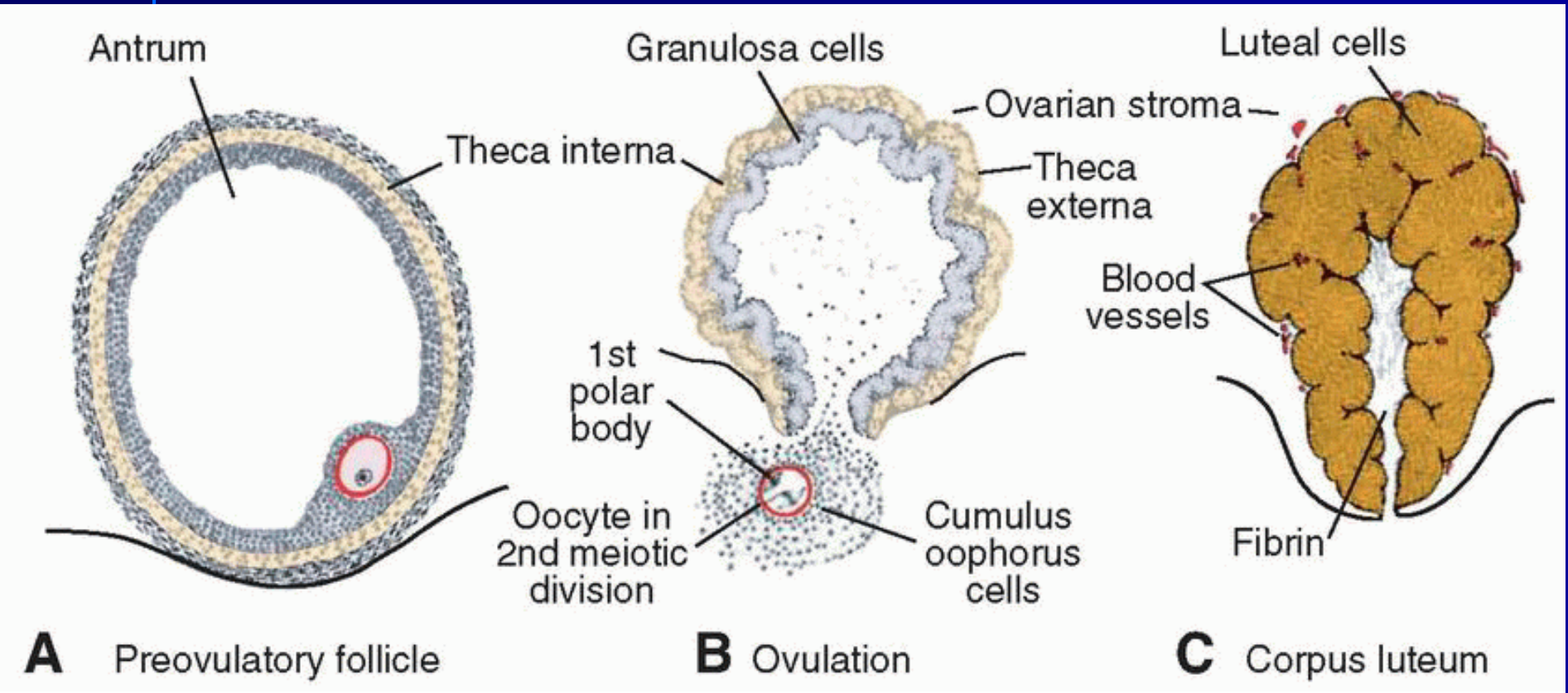
Corpus Atreticum

When a follicle becomes atretic, the oocyte and surrounding follicular cells degenerate and are replaced by connective tissue, forming a ***corpus atreticum***

CORPUS LUTEUM

- Is the progesterone secreting granulosa and theca interna cells of the ruptured follicle that become polyhedral and yellow with increased vascularization by the LH effect.
- Progesterone, together with estrogen hormone, causes the uterine mucosa to enter the ***progestational*** or ***secretory stage*** in preparation for implantation of the embryo

CORPUS LUTEUM



OOCYTE TRANSPORT

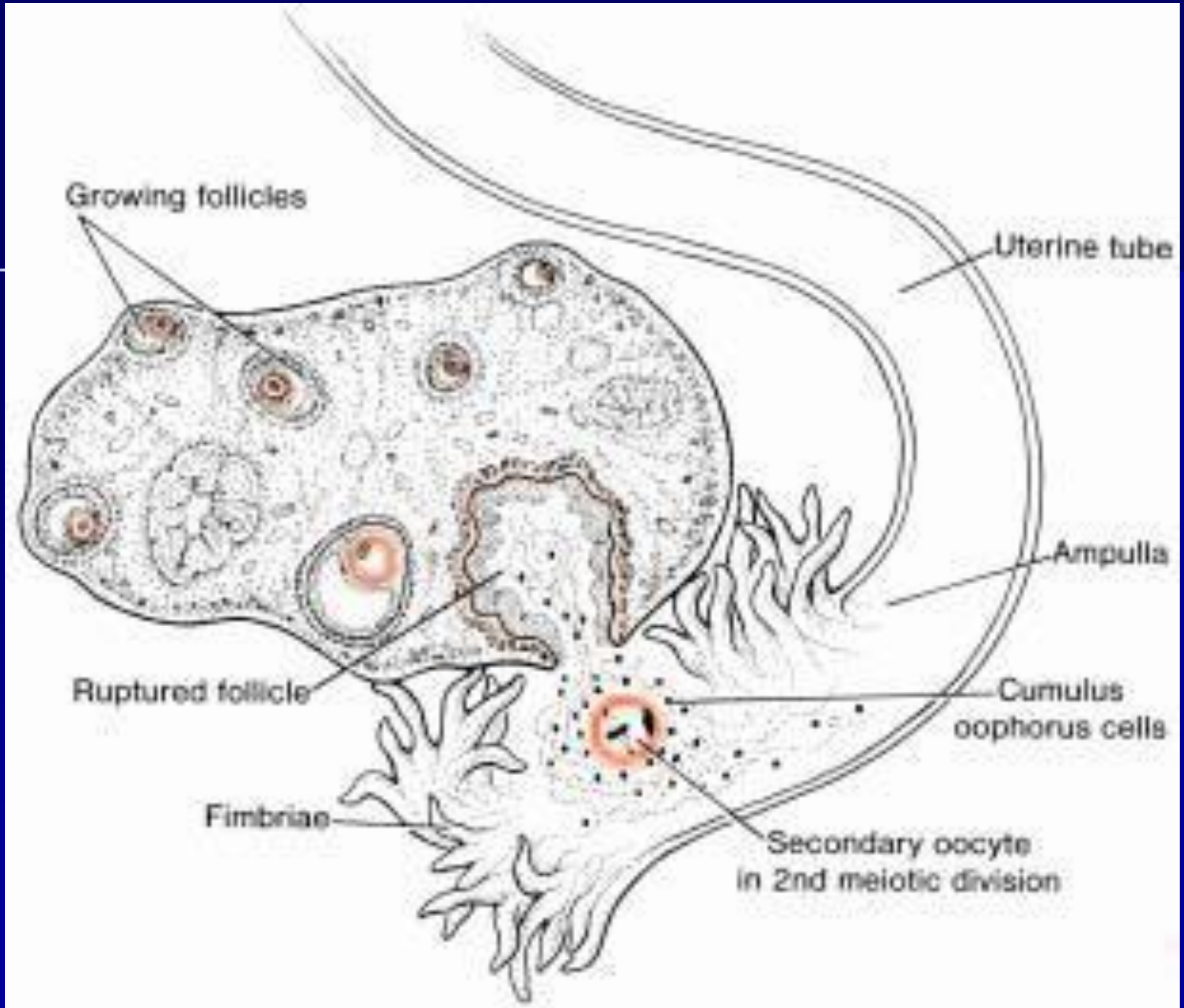
- Shortly before ovulation, fimbriae of the oviduct begin to sweep over the surface of the ovary, and the tube itself begins to contract rhythmically
- The ovulated oocyte with its surrounding cumulus cells swept into the uterine tube by the action of the tubal fimbriae and its moving ciliated epithelium, the tube contract rhythmically pushing the oocyte to reach the uterine lumen in about 4 days.

OOCYTE TRANSPORT

- Once in the tube, cumulus cells withdraw their cytoplasmic processes from the zona pellucida and lose contact with the oocyte
- The sperms ascent from the vagina into the uterus and its tubes by the action of their *flagella* and by the contractions of the uterus and the tubes.
- Only 1% of the sperms enter the cervix

OOCYTE TRANSPORT

- The sperms remain viable for several days in the isthmus of the uterine tube waiting for the ovulated oocyte.
- Fertilization occur in the ampulary wide lateral 1/3 of the tube.


Growing follicles
Uterine tube
Ampulla
Ruptured follicle
Cumulus
oophorus cells
Fimbriae
Secondary oocyte
in 2nd meiotic division

CORPUS ALBICANS

- The max development of the corpus luteum at the 9^{th} day after ovulation. if no fertilization occur it will degenrate.
- Its formation accompanied by decreased progesterone secretion resulting in menstrual bleeding

Corpus Luteum Graviditatis (of pregnancy)

- Is the growing corpus luteum after fertilzartion that induced by human chrionic gonadotropin hormone secreted from the syncytiotrophoblast cells of the developing placenta.
- It may reach about half of the ovarian size at the end of the 3rd month of development,
- It secrets progesterone until the end of the 3^{rd} or 4^{th} month. After this period, the progesterone is secreted by the trophblastic cells of the developing placenta.

THE END

THANK YOU