Figure (1)

A. Primordial follicle. B. Growing follicle. C. Vesicular follicle.

Every day from the pool of primordial follicles A, some begin to develop into growing follicles B, and this growth is independent of FSH. Then, as the cycle progresses, FSH secretion recruits growing follicles to begin development into vesicular (antral) follicles. C. During the last few days of maturation of vesicular follicles, estrogens, produced by follicular and thecal cells, stimulate increased production of LH by the pituitary gland (1), and this hormone causes the follicle to enter the mature vesicular (graafi an) stage, to complete meiosis I, and to enter meiosis II, where it is arrested in metaphase approximately 3 hours before ovulation.

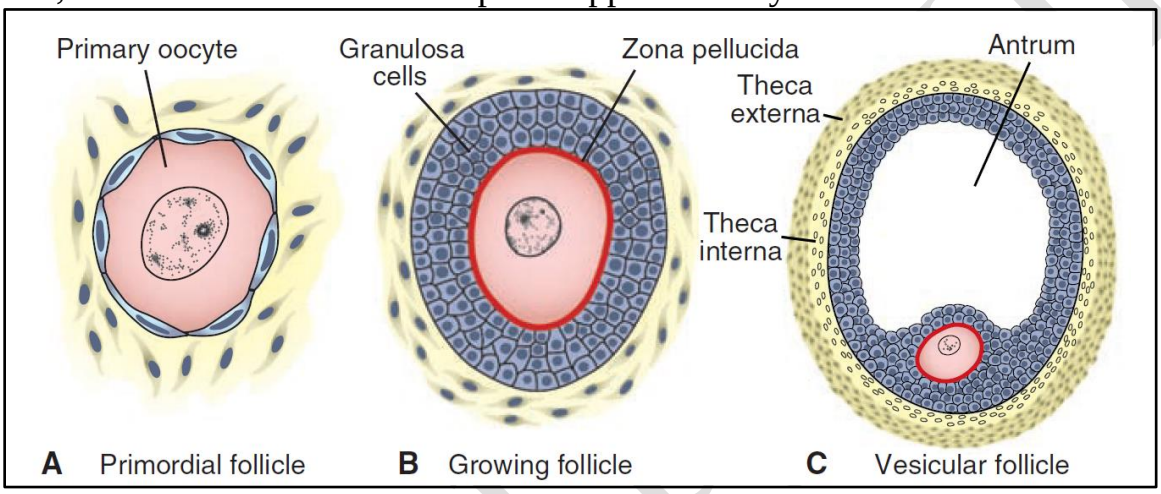


Figure (2)

A. Mature vesicular 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.

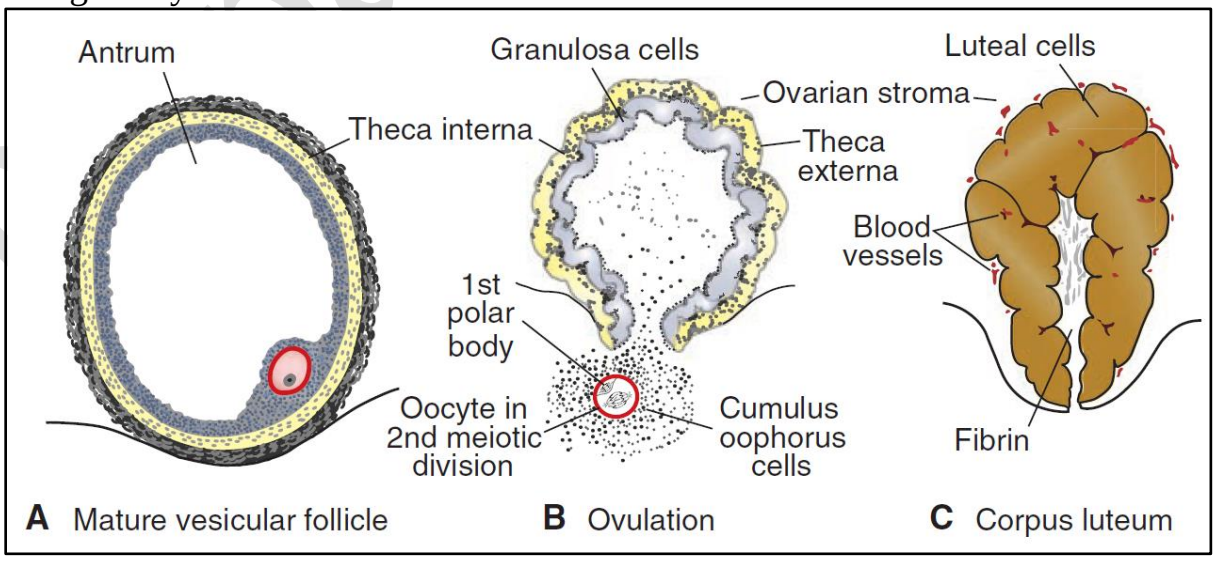


Figure (3)

Relation of fimbriae and ovary.

Fimbriae collect the oocyte and sweep it into the uterine tube.

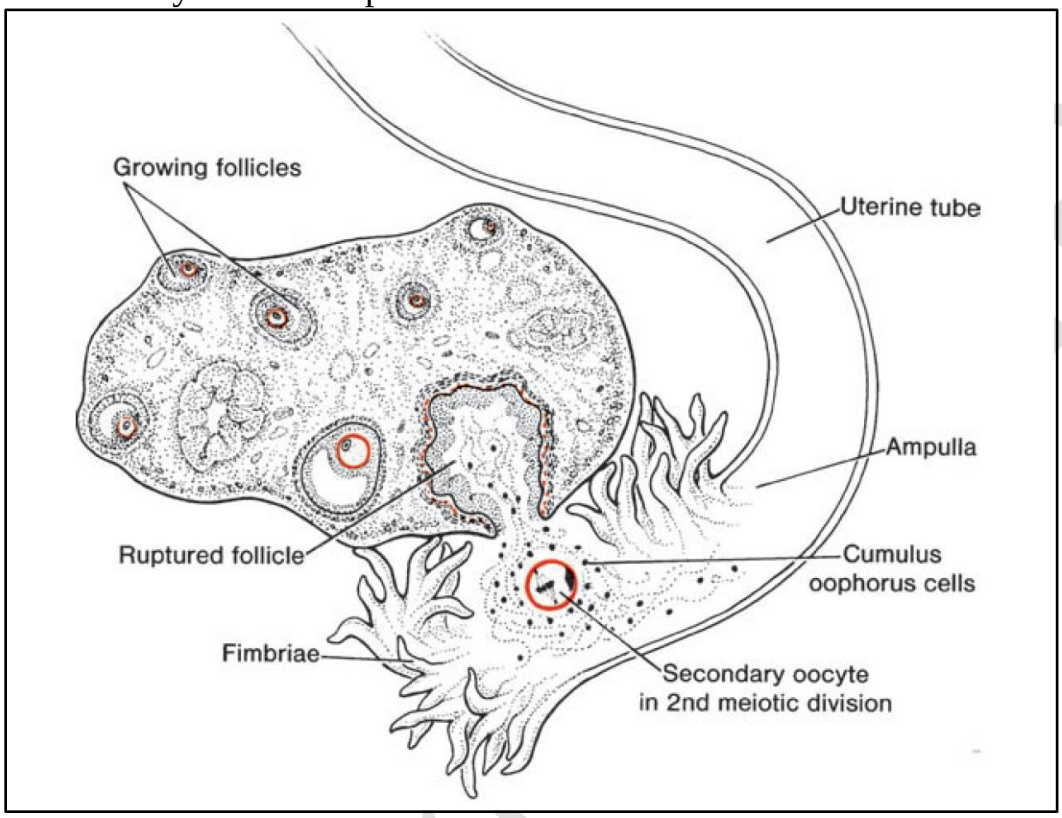


Figure (4)

A. Scanning electron micrograph of sperm binding to the zona pellucida. B. The three phases of oocyte penetration.

In phase 1, spermatozoa pass through the corona radiata barrier; in phase 2, one or more spermatozoa penetrate the zona pellucida; in phase 3, one spermatozoon penetrates the oocyte membrane while losing its own plasma membrane. Inset shows normal spermatocyte with acrosomal head cap.

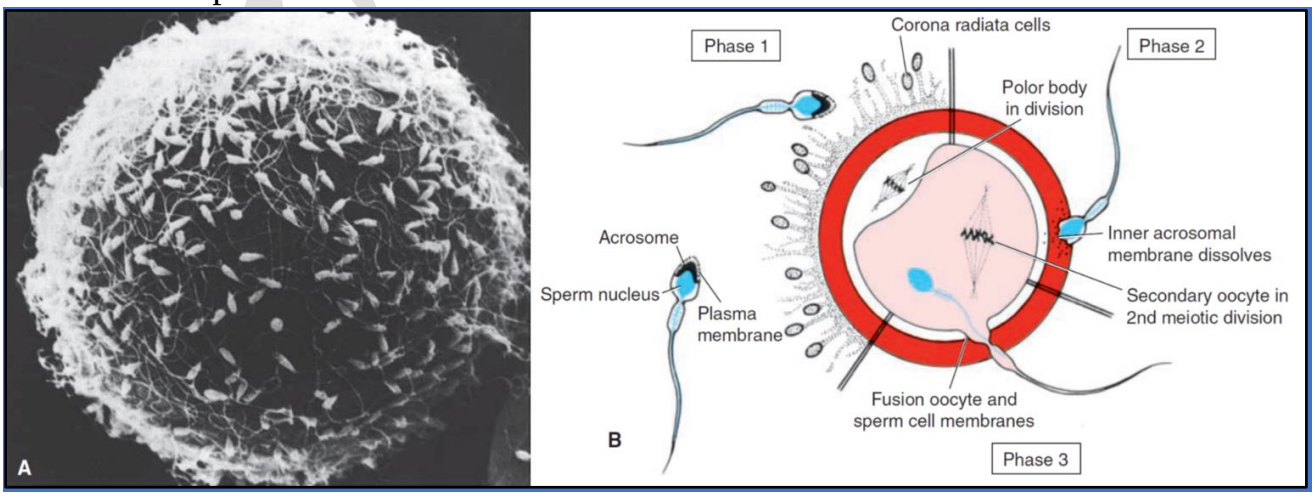


Figure (5)

Development of the zygote from the two-cell stage to the late morula stage. The two-cell stage is reached approximately 30 hours after fertilization; the four-cell stage is reached at approximately 40 hours; the 12- to 16-cell stage is reached at approximately 3 days; and the late morula stage is reached at approximately 4 days. During this period, blastomeres are surrounded by the zona pellucida, which disappears at the end of the fourth day.

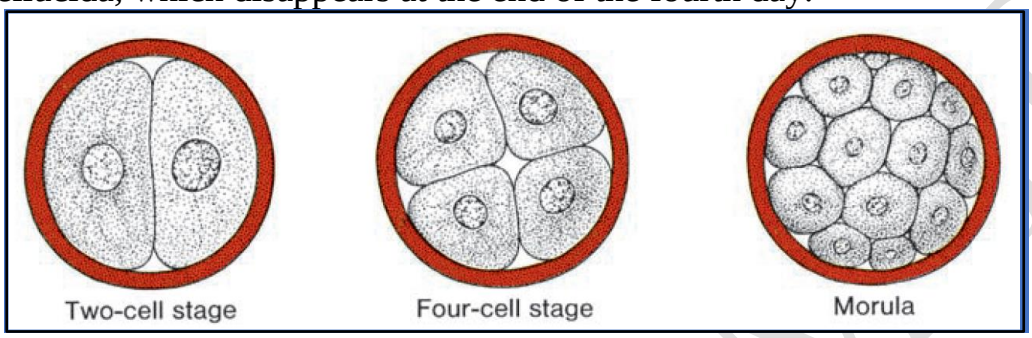


Figure (6)

A. Section of a 107-cell human blastocyst showing inner cell mass and trophoblast cells. B. Schematic representation of a human blastocyst recovered from the uterine cavity at approximately 4.5 days. Blue, inner cell mass or embryoblast; green, trophoblast. C. Schematic representation of a blastocyst at the sixth day of development showing trophoblast cells at the embryonic pole of the blastocyst penetrating the uterine mucosa. The human blastocyst begins to penetrate the uterine mucosa by the sixth day of development.

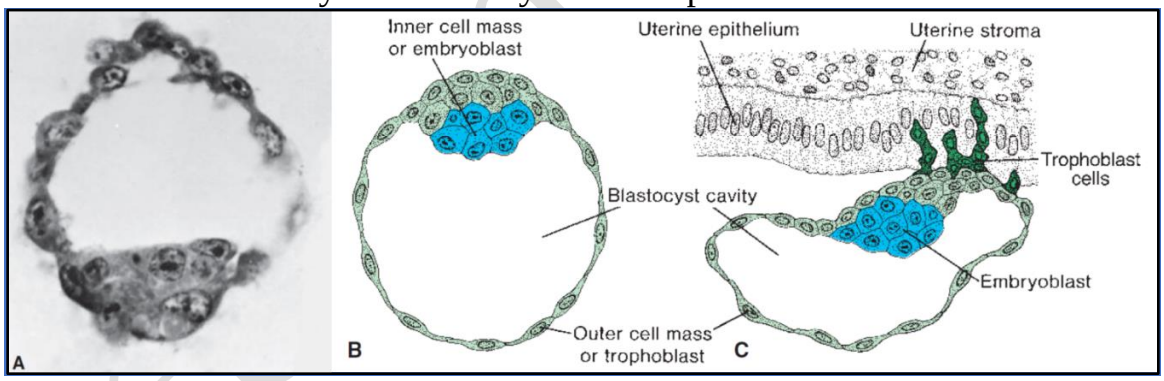


Figure (7)

Events during the first week of human development. 1, oocyte immediately after ovulation; 2, fertilization, approximately 12 to 24 hours after ovulation; 3, stage of the male and female pronuclei; 4, spindle of the fi rst mitotic division; 5, two-cell stage (approximately 30 hours of age); 6, morula containing 12 to 16 blastomeres (approximately 3 days of age); 7, advanced morula stage reaching the uterine lumen (approximately 4 days of age); 8, early blastocyst stage (approximately 4.5 days of age; the zona pellucida has disappeared); and 9, early phase of implantation (blastocyst approximately 6 days of age). The ovary shows stages of transformation between a primary follicle and a preovulatory follicle as well as a corpus luteum. The uterine endometrium is shown in the progestational stage.

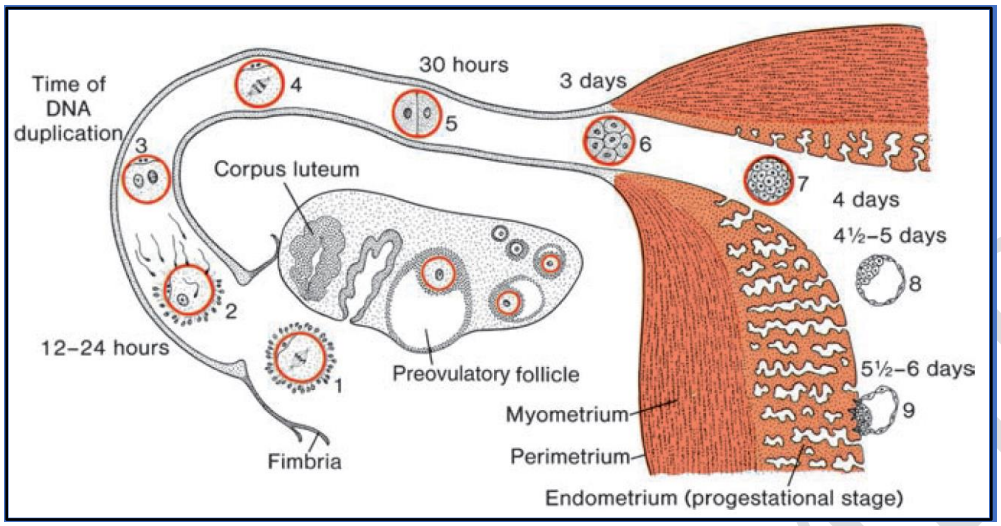
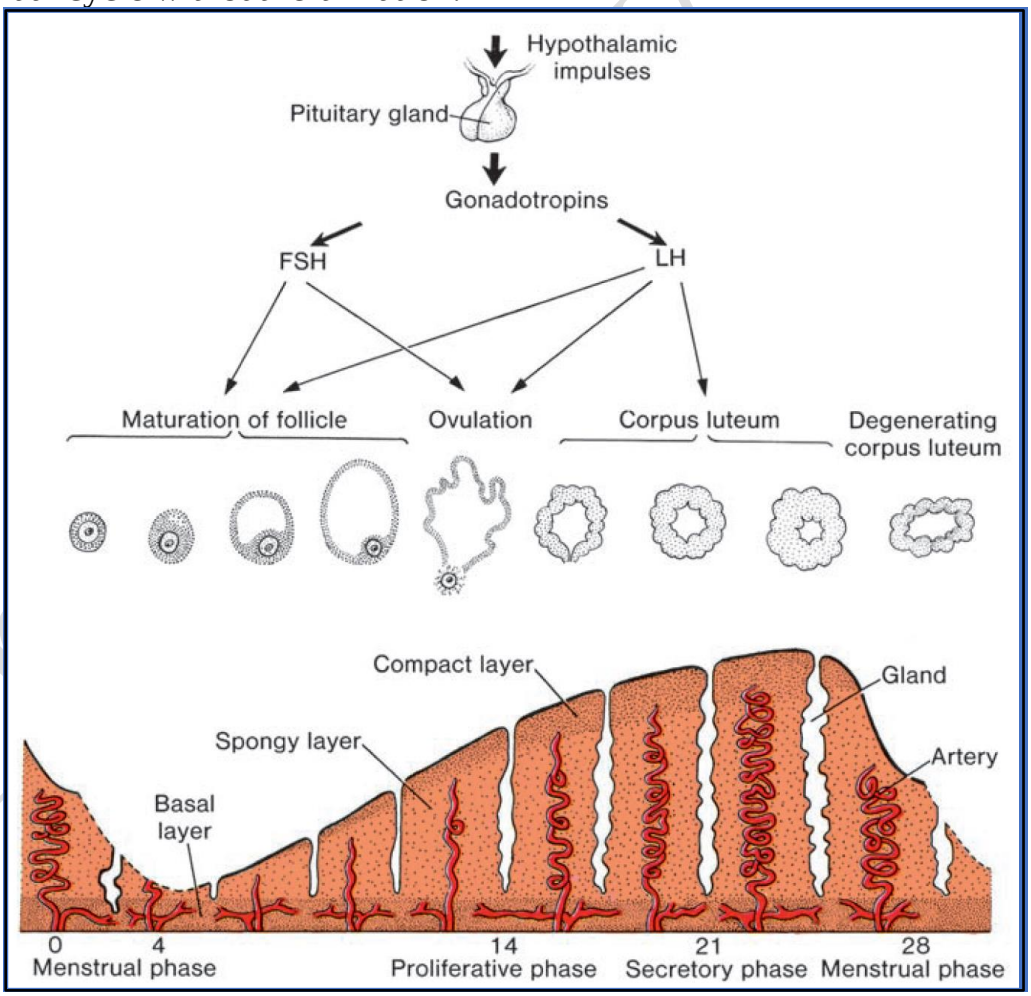


Figure (8)

Changes in the uterine mucosa (endometrium) and corresponding changes in the ovary during a regular menstrual cycle without fertilization.



Summary

- With each **ovarian cycle**, a number of primary follicles begin to grow, but usually only one reaches full maturity, and only one oocyte is discharged at ovulation.
- At **ovulation**, the oocyte is in metaphase of the second meiotic division and is surrounded by the zona pellucida and some granulosa cells.
- Sweeping action of tubal fimbriae carries the oocyte into the uterine tube.
- Before spermatozoa can fertilize the oocyte, they must undergo
  (1) **Capacitation** during which the glycoprotein coat and seminal plasma proteins are removed from the spermatozoon head
  (2) **The acrosome reaction**, during which acrosin- and trypsin-like substances are released to penetrate the zona pellucida.
- During fertilization, the spermatozoon must penetrate:
  1. The corona radiata
  2. The zona pellucida
  3. The oocyte cell membrane.
- As soon as the spermatocyte has entered the oocyte,
  1. The oocyte completes its second meiotic division and forms the female pronucleus
  2. The zona pellucida becomes impenetrable to the other spermatozoa
  3. The head of the sperm separates from the tail, swells, and forms the male pronucleus.
- After both pronuclei have replicated their DNA, paternal and maternal chromosomes intermingle, split longitudinally, and go through a mitotic division, giving rise to the two-cell stage.
- The results of fertilization are
  1. Restoration of the diploid number of chromosomes
  2. Determination of chromosomal sex
  3. Initiation of cleavage
- **Cleavage** is a series of mitotic divisions that results in an increase in cells, blastomeres, which become smaller with each division.
- After three divisions, the blastomeres undergo compaction to become a tightly grouped ball of cells with inner and outer layers.
- Compacted blastomeres divide to form a **16-cell morula**.

- As the morula enters the uterus on the third or fourth day after fertilization, the cavity begins to appear, and the **blastocyst** forms.
- The **inner cell mass** that is formed at the time of compaction and will develop into the embryo proper is at one pole of the blastocyst.
- The **outer cell mass** that surrounds the inner cells and the cavity of the blastocyst will form the trophoblast.
- The uterus at the time of implantation is in the secretory phase, and the blastocyst implants in the endometrium along the anterior or posterior wall.
- If fertilization does not occur, then the menstrual phase begins, and the spongy and compact endometrial layers are shed, the basal layer remains to regenerate the other layers during the next cycle.