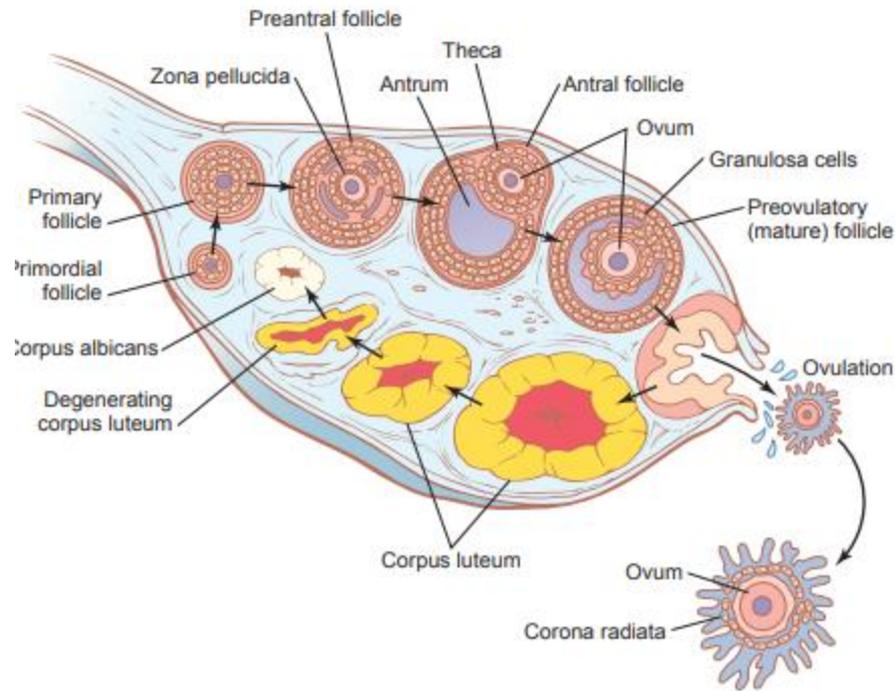


Fig 82- 3

# Oogenesis

- During early embryonic development, primordial germ cells from the dorsal endoderm of the yolk sac migrate along the mesentery of the hindgut to the outer surface of the ovary, which is covered by a germinal epithelium, derived embryologically from the epithelium of the germinal ridges. During this migration, the germ cells divide repeatedly.
- Once these primordial germ cells reach the germinal epithelium, they migrate into the substance of the ovarian cortex and become oogonia or primordial ova. Each primordial ovum then collects around it a layer of spindle cells from the ovarian stroma (the supporting tissue of the ovary) and causes them to take on epithelioid characteristics; these epithelioid-like cells are then called granulosa cells.
- The ovum surrounded by a single layer of granulosa cells is called a primordial follicle. At this stage the ovum is still immature and is called a primary oocyte, requiring two more cell divisions before it can be fertilized by a sperm. The oogonia in the embryonic ovary complete mitotic replication and the first stage of meiosis by the fifth month of fetal development. The germ cell mitosis then ceases and no additional oocytes are formed. At birth the ovary contains about 1 to 2 million primary oocytes. The first meiotic division of the oocyte occurs after puberty.
- Each oocyte divides into two cells, a large ovum (secondary oocyte) and a small first polar body. Each of these cells contains 23 duplicated chromosomes. The first polar body may or may not undergo a second meiotic division and then disintegrates. The ovum starts a second meiotic division, and after the sister chromatids separate, there is a pause in meiosis.
- If the ovum is fertilized, the final step in meiosis occurs and the sister chromatids in the ovum go to separate cells. When the ovary releases the ovum (ovulation) and if the ovum is fertilized, the final meiosis occurs. Half of the sister chromatids remain in the fertilized ovum and the other half are released in a second polar body, which then disintegrates. At puberty, only about 300,000 oocytes remain in the ovaries, and only a small percentage of these oocytes become mature. The many thousands of oocytes undergo atresia.

- Fig 82- 5



# Follicular development

- When a female child is born, each ovum is surrounded by a single layer of granulosa cells; the ovum, with this granulosa cell sheath, is called a primordial follicle.
- Throughout childhood, the granulosa cells are believed to provide nourishment for the ovum and to secrete an oocyte maturation inhibiting factor that keeps the ovum suspended in its primordial state in the prophase stage of meiotic division.
- After puberty, when FSH and LH from the anterior pituitary gland begin to be secreted in significant quantities, the ovaries (together with some of the follicles within them) begin to grow.
- The first stage of follicular growth is moderate enlargement of the ovum, which increases in diameter twofold to threefold.
- That stage is followed by growth of additional layers of granulosa cells in some of the follicles. These follicles are known as primary follicles
- Development of Antral and Vesicular Follicles: During the first few days of each monthly female sexual cycle, FSH and LH secreted by the anterior pituitary gland increase slightly to moderately, with the increase in FSH slightly greater than that of LH and preceding it by a few days. These hormones, especially FSH, cause accelerated growth of 6 to 12 primary follicles each month.

# Follicular development

- The initial effect is rapid proliferation of the granulosa cells, giving rise to many more layers of these.
- In addition, spindle cells derived from the ovary interstitium collect in several layers outside the granulosa cells, giving rise to a second mass of cells called the theca.
- The theca is divided into two layers. In the theca interna, the cells take on epithelioid characteristics similar to those of the granulosa cells and develop the ability to secrete additional steroid sex hormones (estrogen and progesterone). The outer layer, the theca externa, develops into a highly vascular connective tissue capsule that becomes the capsule of the developing follicle.
- After the early proliferative phase of growth, which lasts for a few days, the mass of granulosa cells secretes a follicular fluid that contains a high concentration of estrogen, one of the important female sex hormones.
- Accumulation of this fluid causes an antrum to appear within the mass of granulosa cells.
- The early growth of the primary follicle up to the antral stage is stimulated mainly by FSH alone. Greatly accelerated growth then occurs, leading to still larger follicles called vesicular follicles.

# Ovulation

- FSH and LH act synergistically to cause rapid swelling of the follicle during the last few days before ovulation.
  - The LH has a specific effect on the granulosa and theca cells, converting them mainly to progesterone secreting cells. Therefore, the rate of secretion of estrogen begins to fall about 1 day before ovulation.
- (1) rapid growth of the follicle,
  - (2) diminishing estrogen secretion after a prolonged phase of excessive estrogen secretion,
  - (3) initiation of secretion of progesterone that ovulation occurs.
- Without the initial preovulatory surge of LH, ovulation will not occur