

Gametogenesis

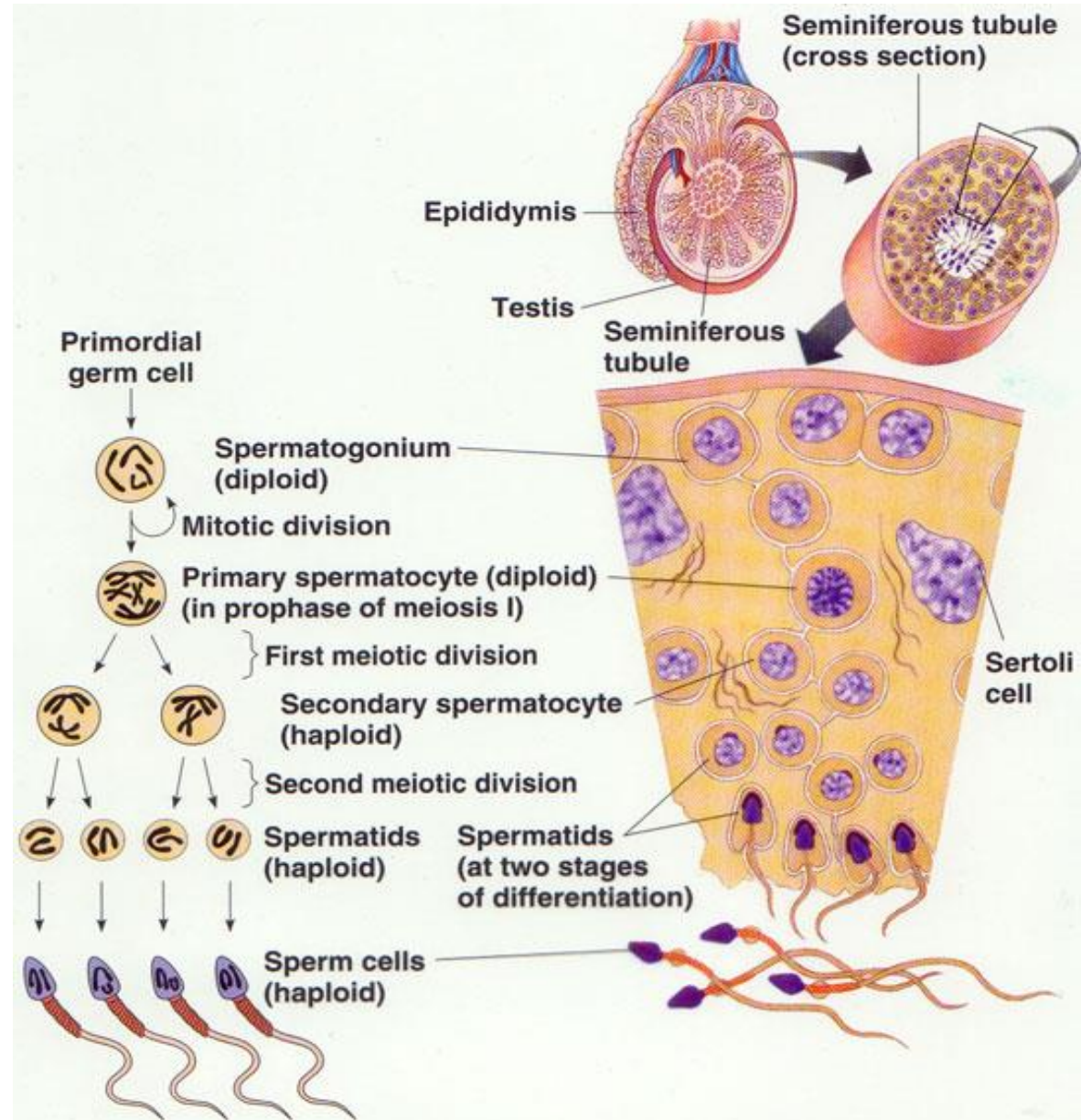
By:

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- Gametogenesis is the production of mature gametes (ova in females and sperms in males).
- In males it is called Spermatogenesis
- In females it is called Oogenesis

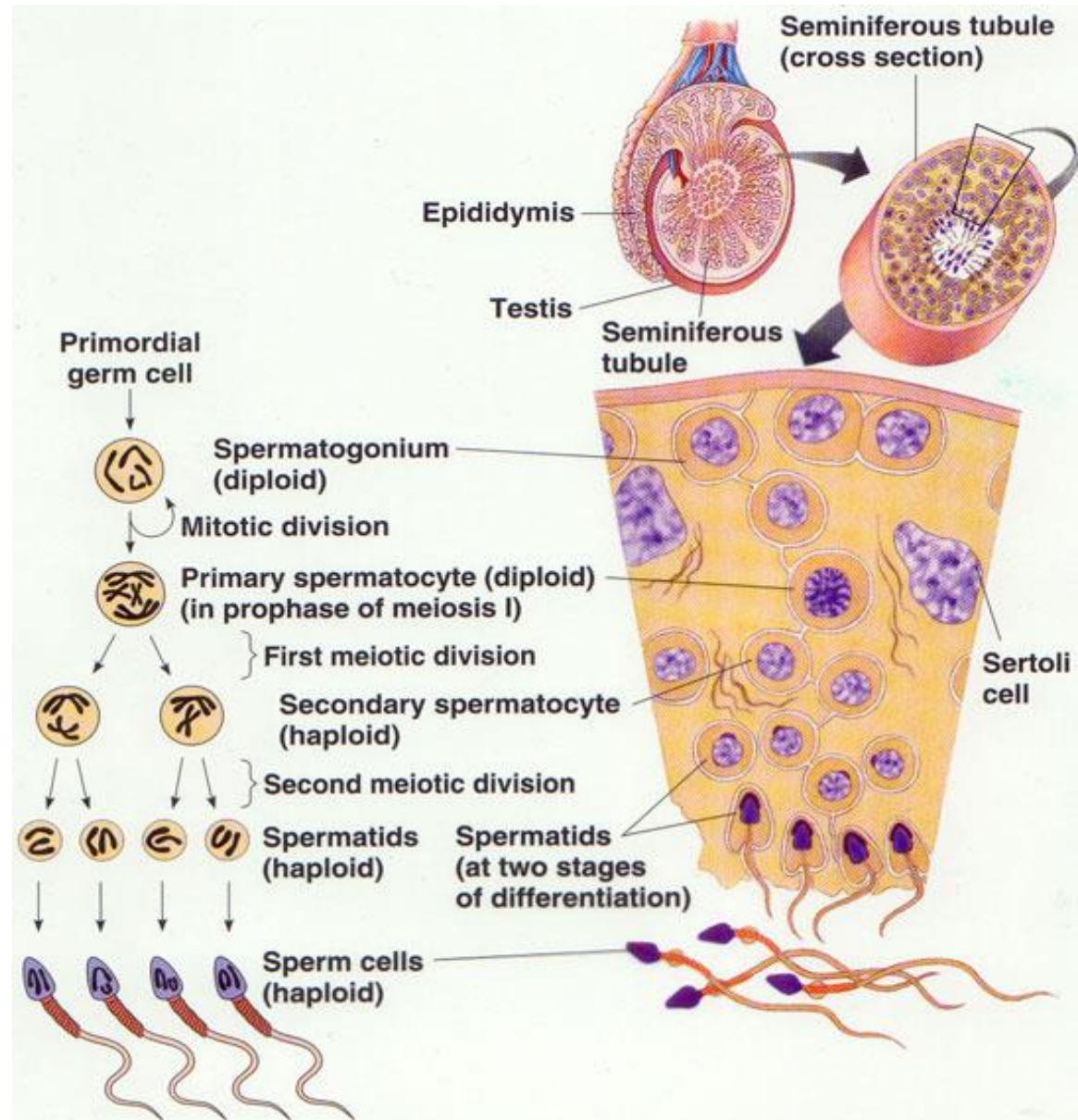
Spermatogenesis

- Process of sperm formation in the seminiferous tubules
- Regulated by LH & FSH hormones
- Primordial Germ Cells stay dormant from 4th week till puberty.
- Then it enters meiosis and produces sperm from puberty until death.



Spermatogenesis

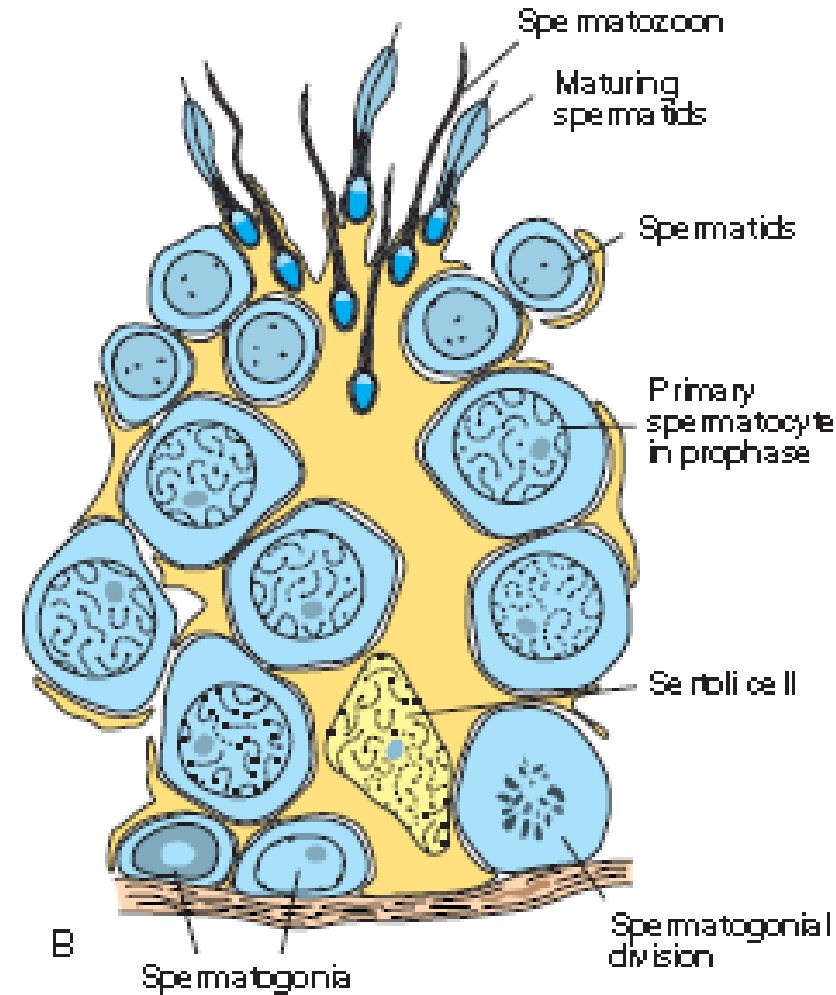
- It has two parts:
 1. Spermatocytogenesis: the development of spermatids from spermatogonia.
 2. Spermiogenesis: the process that converts spermatids into mature sperm (spermatozoa).



- In the male, **primordial cells** remain dormant until puberty, and only then do they differentiate into

spermatogonia

These stem cells have a renewable pool and give rise to **primary spermatocytes**, which through two successive meiotic divisions produce four **spermatids**



Spermiogenesis

1. Formation of the acrosome.
2. Condensation of the nucleus.
3. Formation of the neck and tail.
4. Shedding of most of the cytoplasm.

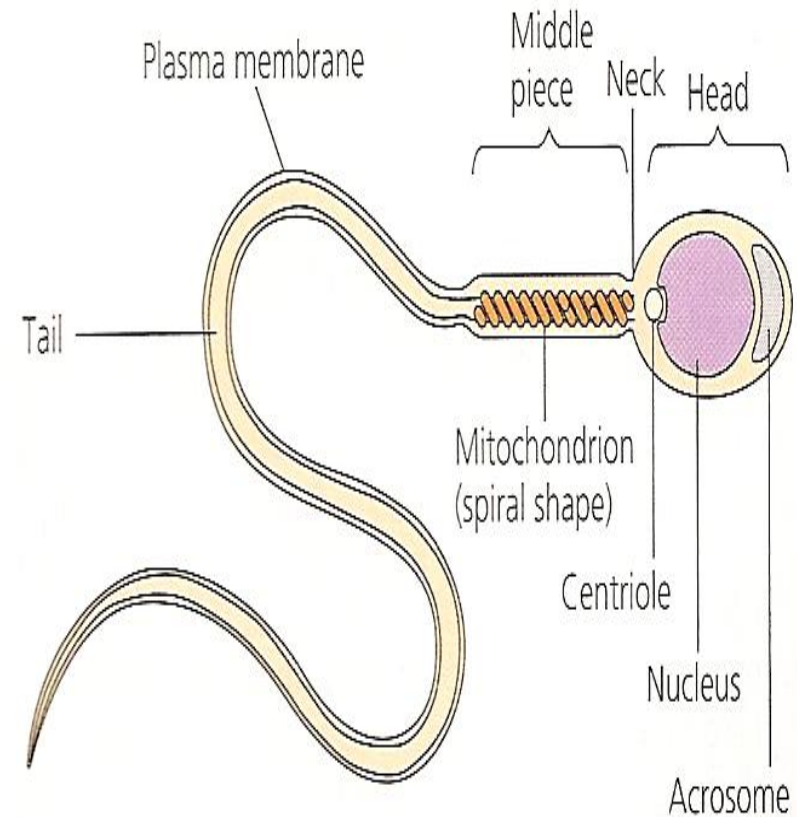


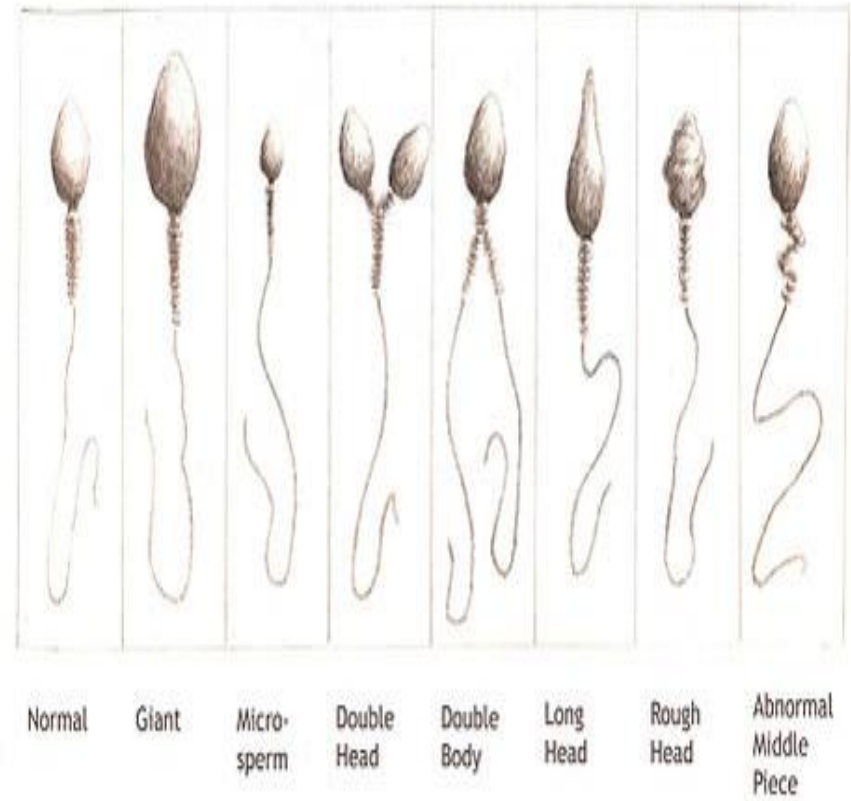
FIGURE 46.12 Structure of a human sperm cell.

- Spermatogenesis takes 65-75 days
- About 300 million per day
- All sperms have 22 autosomes and either an x or y chromosome.
- Affected by hormones, temp, radiation and drugs.
- 50% of sperms becomes motile after 2 hrs.

Sperm abnormalities

- Lacks normal shape or motility.
- Do not fertilize the ova.

Sperm Morphology

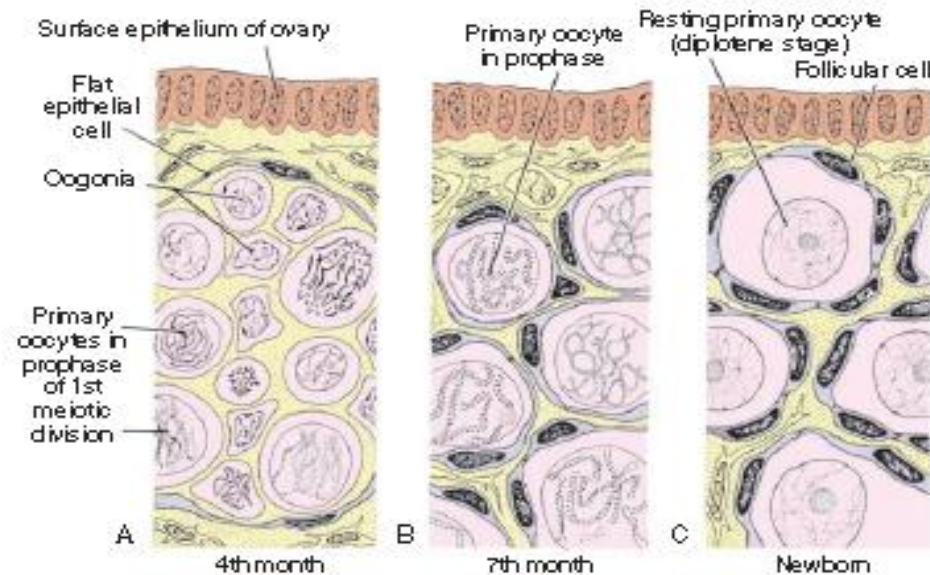
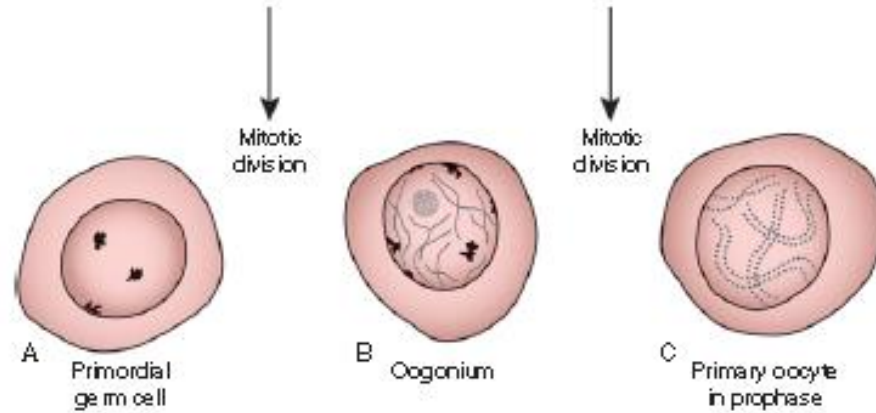


Oogenesis

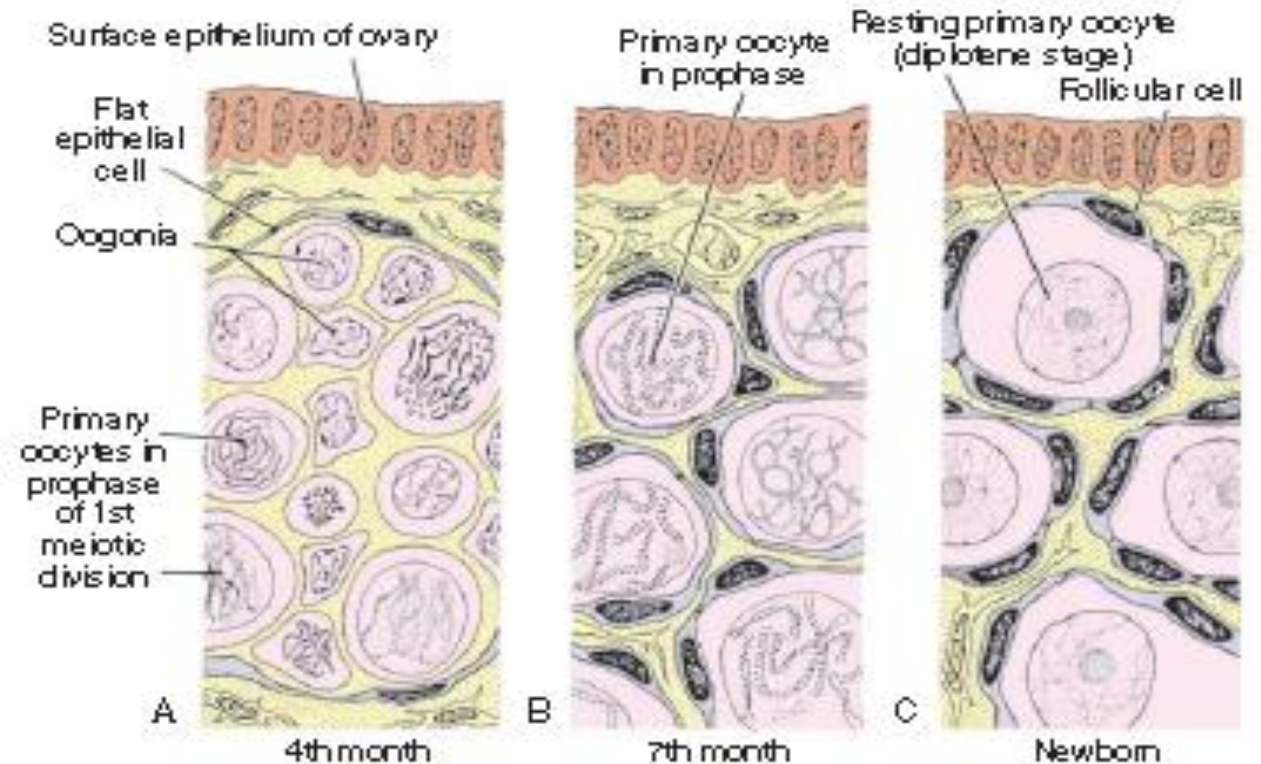
- Gametogenesis in females
- Sequence of events by which primitive germ cells called **oogonia** are transformed into mature **oocytes**.
- Process begins before birth and will not be completed until (and if) fertilization occurs.
- Oogonia increase in number by mitosis.
- By the 5th month of **prenatal development**, the total number of oogonia reaches its maximum, approximately 7 million.

- In the female, maturation from primitive germ cell (oogonia) to mature gamete, which is called oogenesis, begins before birth.

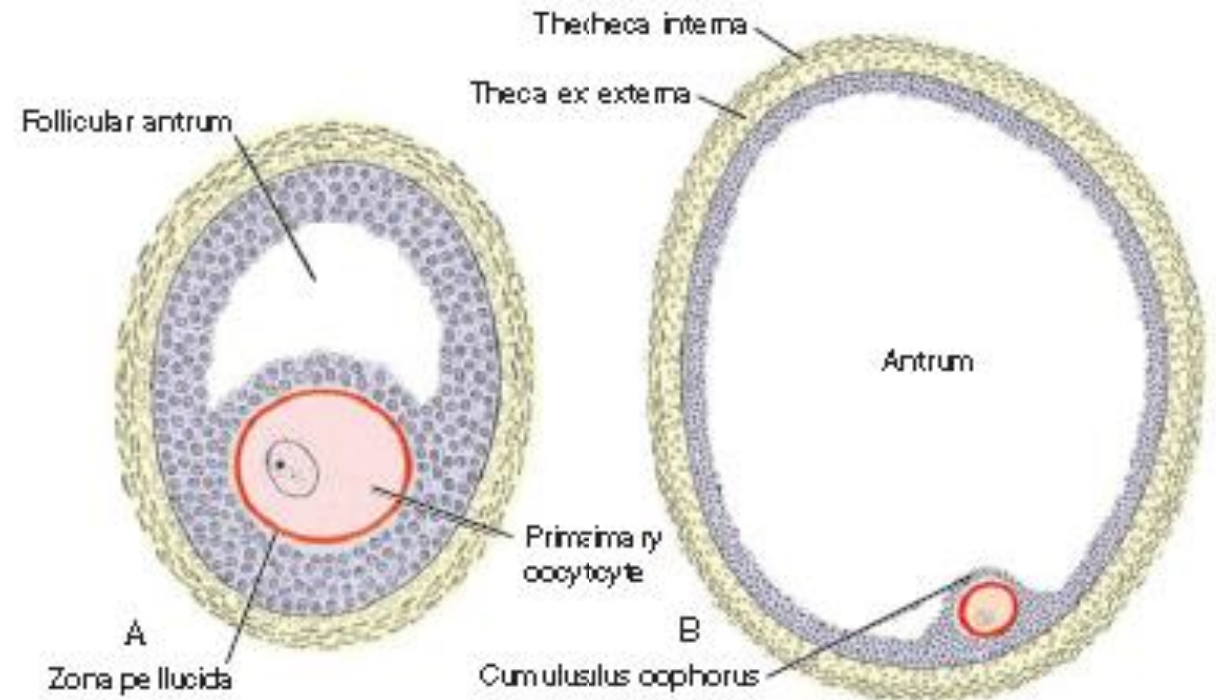
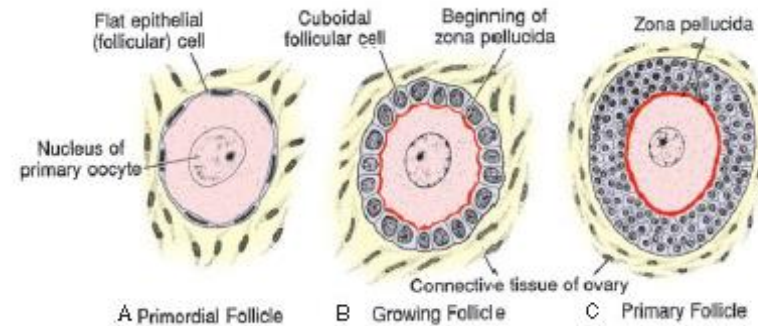
- In the female, **primordial germ cells form oogonia**. After repeated mitotic divisions, some of these arrest in prophase of meiosis I to form **primary oocytes**



- By the seventh month, nearly all oogonia have become atretic,
- only primary oocytes remain surrounded by a layer of follicular cells derived from the surface epithelium of the ovary
- Together, they form the **primordial follicle**

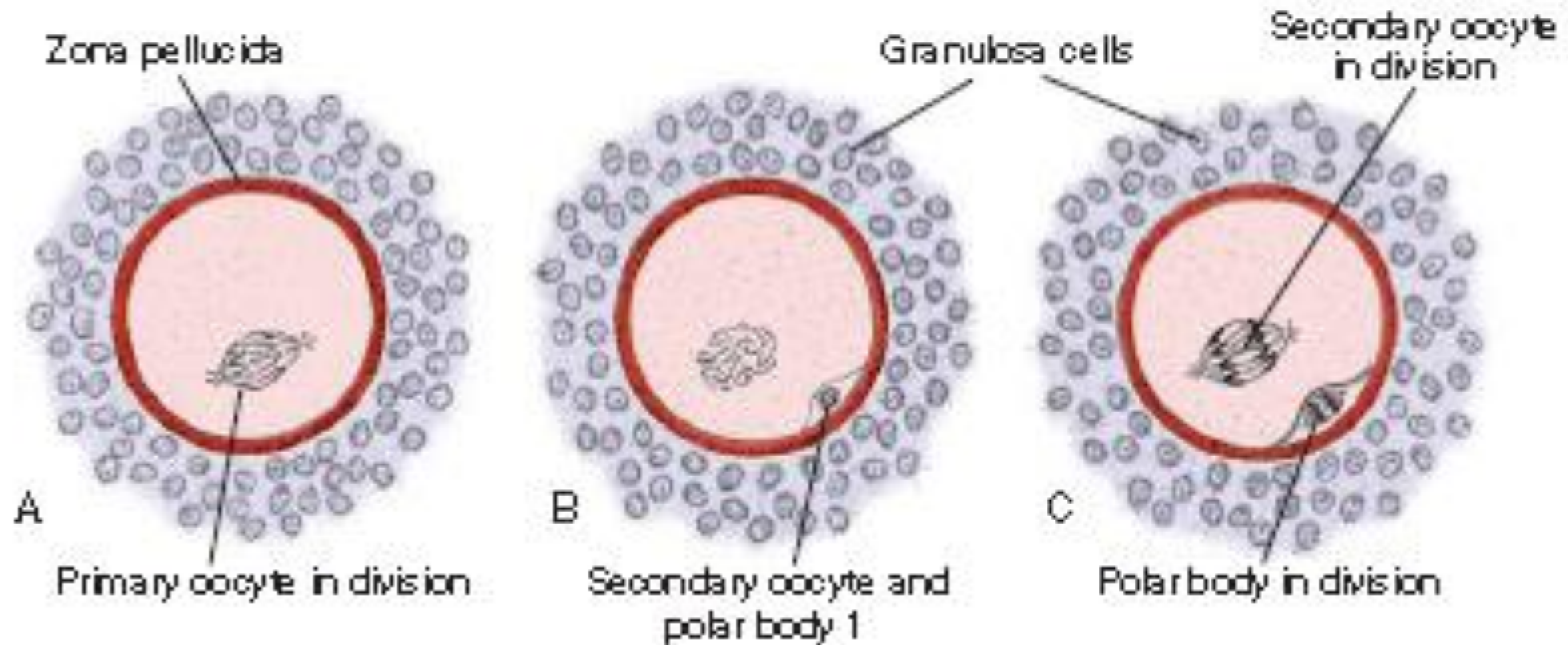


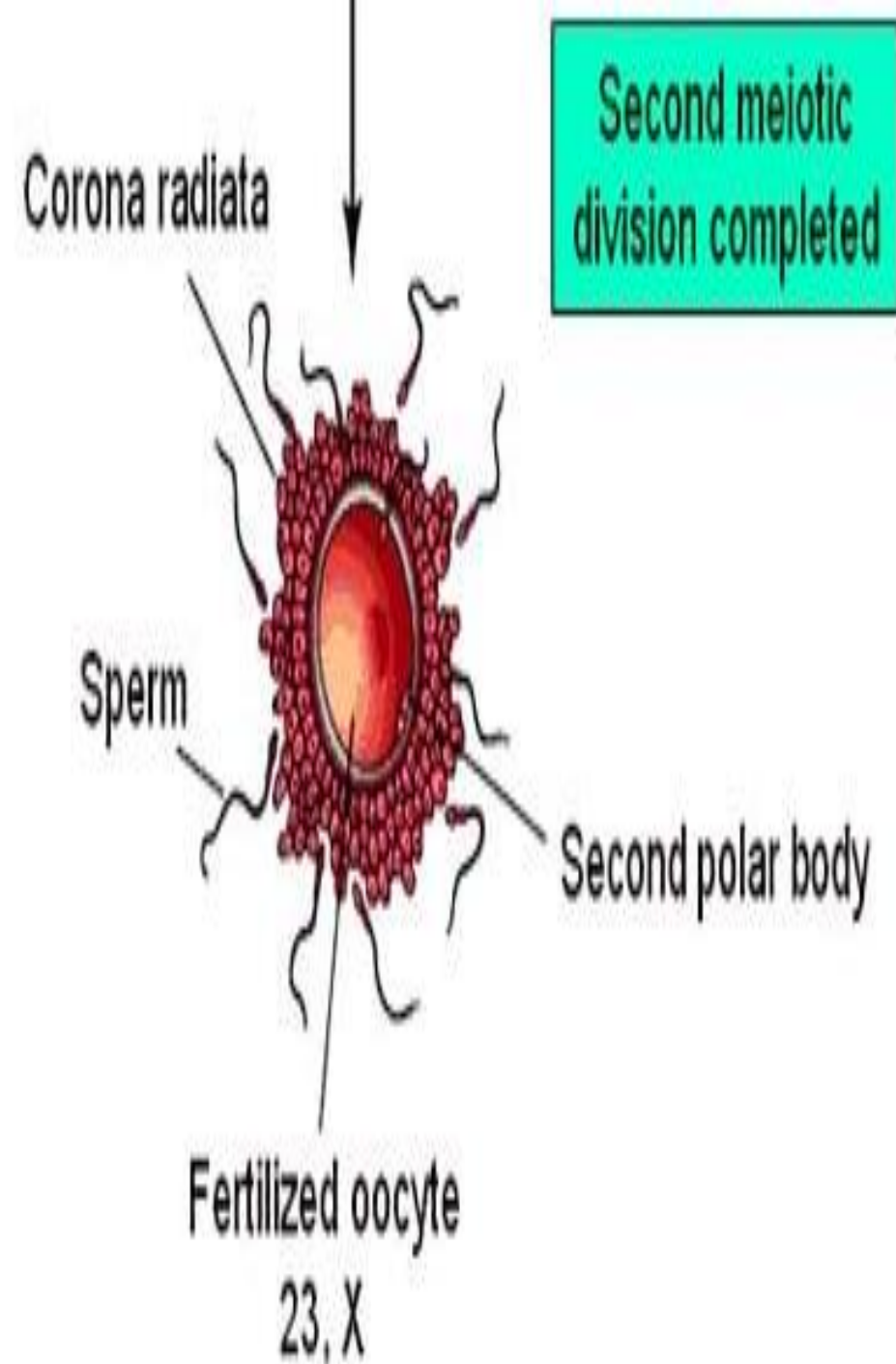
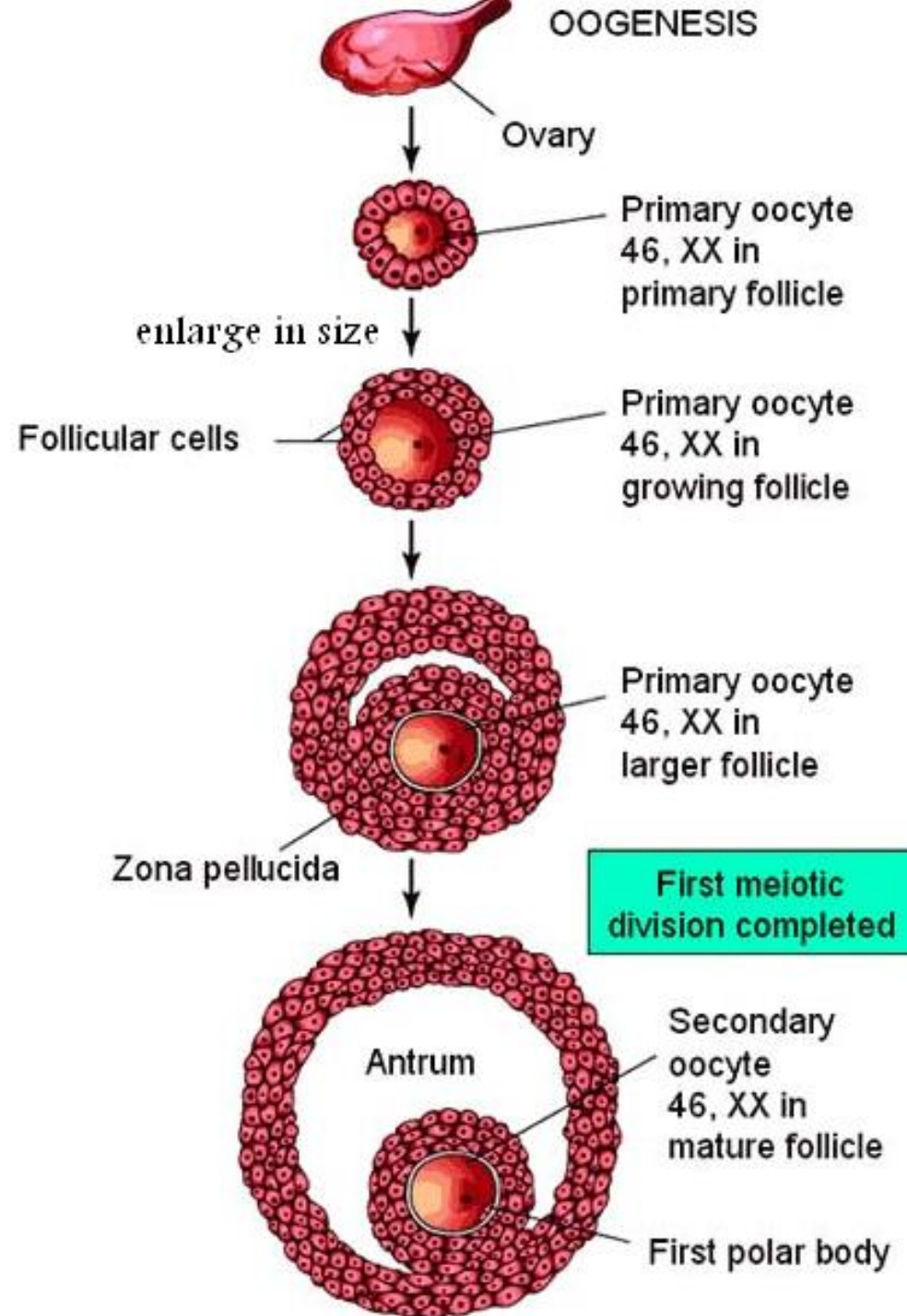
- At puberty, a pool of growing follicles is recruited and maintained from the finite supply of primordial follicles.
- The follicles begin to grow, and as they **mature**, they pass through three stages:
 - 1) Primary or preantral
 - 2) secondary or antral (vesicular, Graafian)
 - 3) preovulatory



- The primary oocyte remains in prophase of the first meiotic division until the secondary follicle is mature.
- At this point, a surge in luteinizing hormone (LH) stimulates preovulatory growth: meiosis I is completed and a **secondary oocyte** and polar body are formed

- Then, the secondary oocyte is arrested in metaphase of meiosis II approximately 3 hours before ovulation and will not complete this cell division until fertilization





Ovarian cycle:

- Its periodic changes (every 28 days) which occur in the cortex of the ovary from puberty till menopause. Its divided into three phases:

1.The follicular phase:

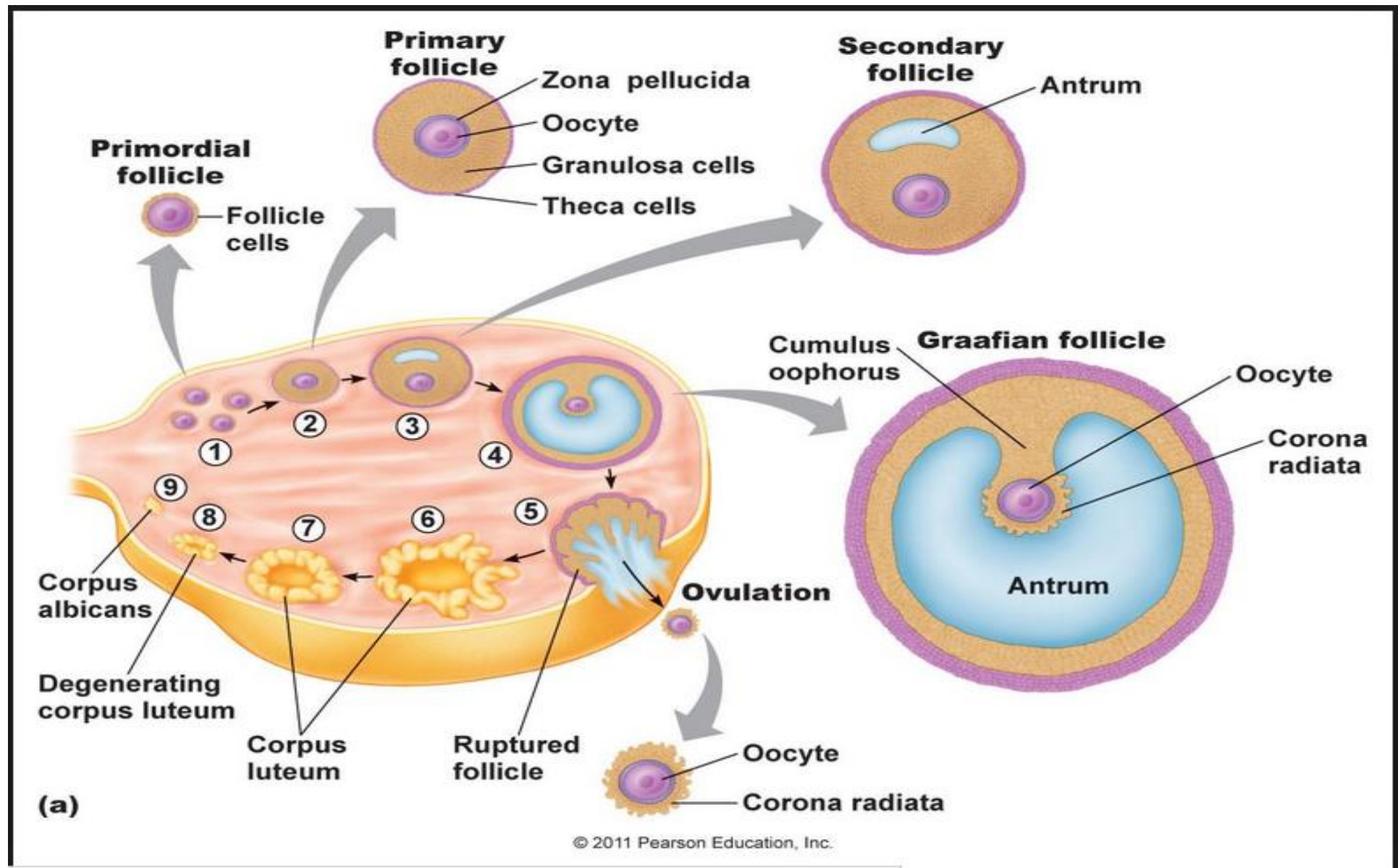
the development of **primary follicle** into – **mature graafian follicle**.

2.Ovulation:

the **rupture of mature (graafian) follicle** and release of the ovum into the uterine tube.

It occurs on the 14th day.

- *3.The luteal phase:*
- It's the transformation of the ruptured follicle into – corpus luteum (yellow body) due to the effect of the luteinizing hormone(LH) of the anterior pituitary.
- If fertilization did not occur the corpus luteum persist for 10-14 days & then it degenerates & the cycle is then repeated once more.



The Ovarian cycle

- Near the time of birth, all primary oocytes have started prophase of meiosis I, but instead of proceeding into metaphase, they enter the **diplotene stage**, a resting stage during prophase that is characterized by a lacy network of chromatin.
- **Primary oocytes remain in prophase and do not finish their first meiotic division before puberty is reached**, apparently because of **oocyte maturation inhibitor (OMI)**, a substance secreted by follicular cells.
- The total number of primary oocytes at birth is estimated to vary from 700,000 to 2 million. During childhood most oocytes become atretic; only approximately 400,000 are present by the beginning of puberty, and fewer than 500 will be ovulated.

- At puberty, a pool of growing follicles is established and continuously maintained from the supply of primordial follicles. Each month, 15 to 20 follicles selected from this pool begin to mature, passing through three stages:
- 1) **primary** or **preantral**
- 2) **secondary** or **antral** (also called **vesicular** or **Graafian**);
- 3) **preovulatory**.
- The antral stage is the longest, whereas the preovulatory stage encompasses approximately 37 hours before ovulation.
- As the primary oocyte begins to grow, surrounding follicular cells change from flat to cuboidal and proliferate to produce a stratified epithelium of **granulosa cells**, is called a **primary follicle**

- When the secondary follicle is mature, a surge in **luteinizing hormone (LH)** induces the preovulatory growth phase. Meiosis I is completed, resulting in formation of two daughter cells of unequal size, each with 23 double stranded:
 1. One cell, the **secondary oocyte**, receives most of the cytoplasm. The cell then enters meiosis II but arrests in metaphase approximately 3 hours before ovulation. Meiosis II is completed only if the oocyte is fertilized; otherwise, the cell degenerates approximately 24 hours after ovulation.
 2. The other, the **first polar body**, receives practically none and lies between the zona pellucida and the cell membrane of the secondary oocyte in the perivitelline space. Also undergoes a second division

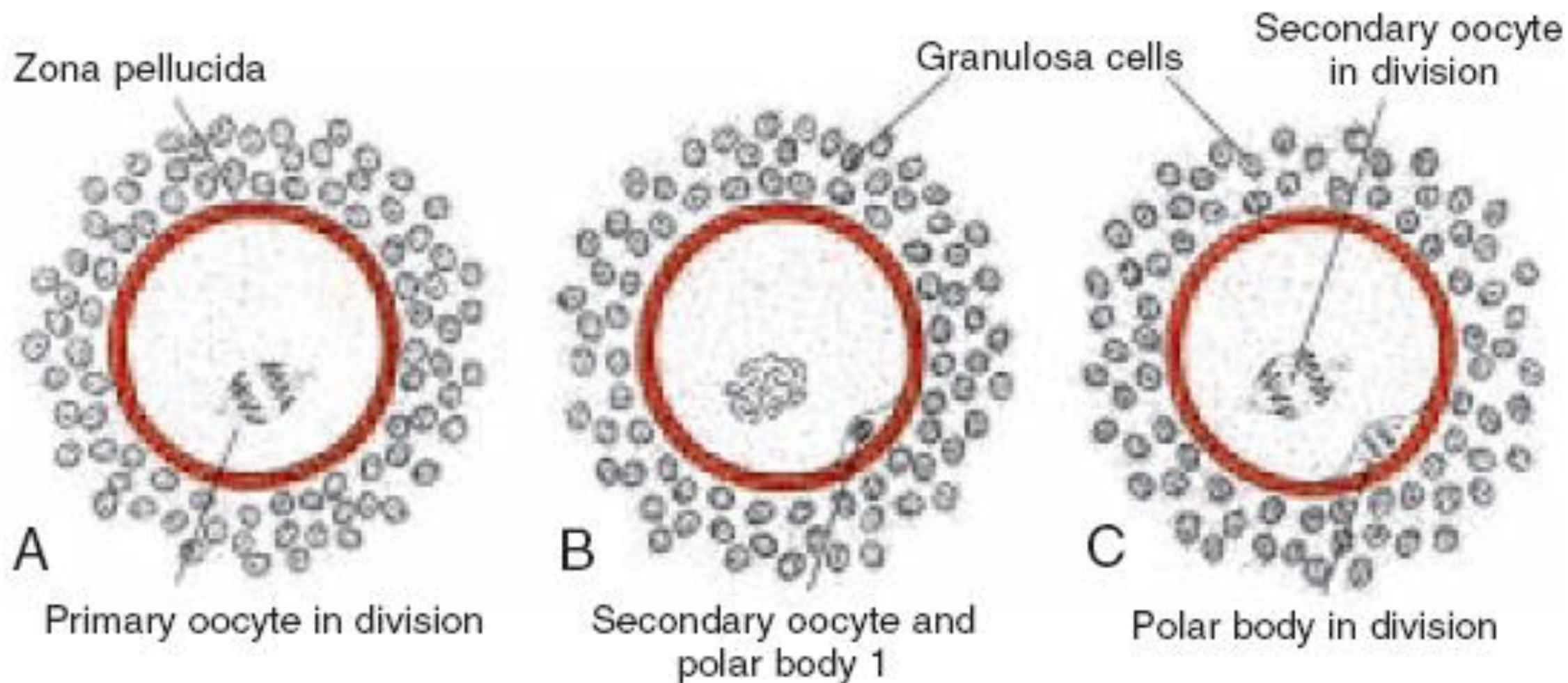
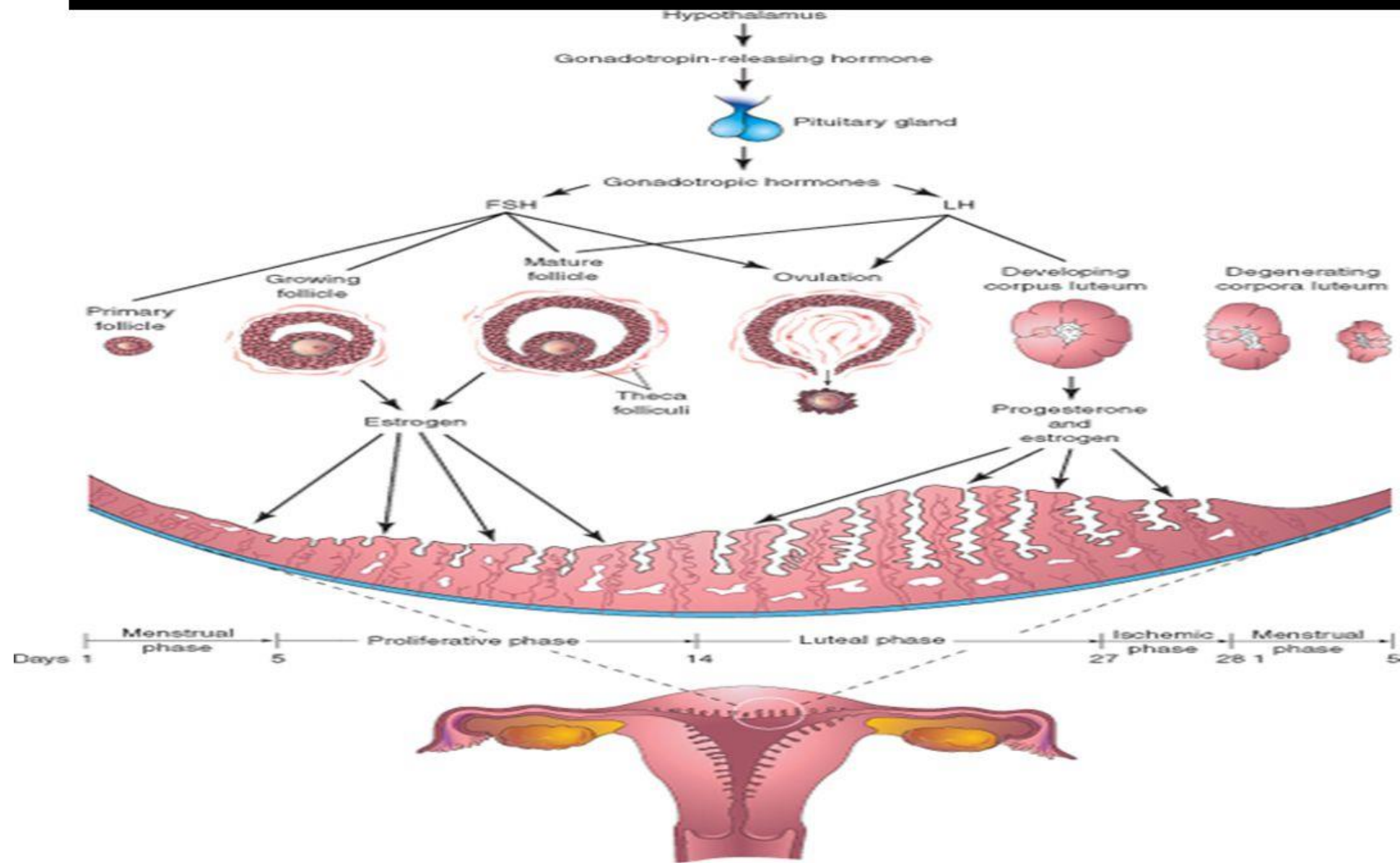


Figure 1.20 Maturation of the oocyte. **A.** Primary oocyte showing the spindle of the first meiotic division. **B.** Secondary oocyte and first polar body. The nuclear membrane is absent. **C.** Secondary oocyte showing the spindle of the second meiotic division. The first polar body is also dividing.

Hormonal control of ovarian cycle

- In the first half of cycle, the anterior puituitary secretes follicular stimulating hormone (F.S.H) which cause:
 - 1.Growth of the primary follicle.
 - 2.Libration of estrogen hormone by the follicle.



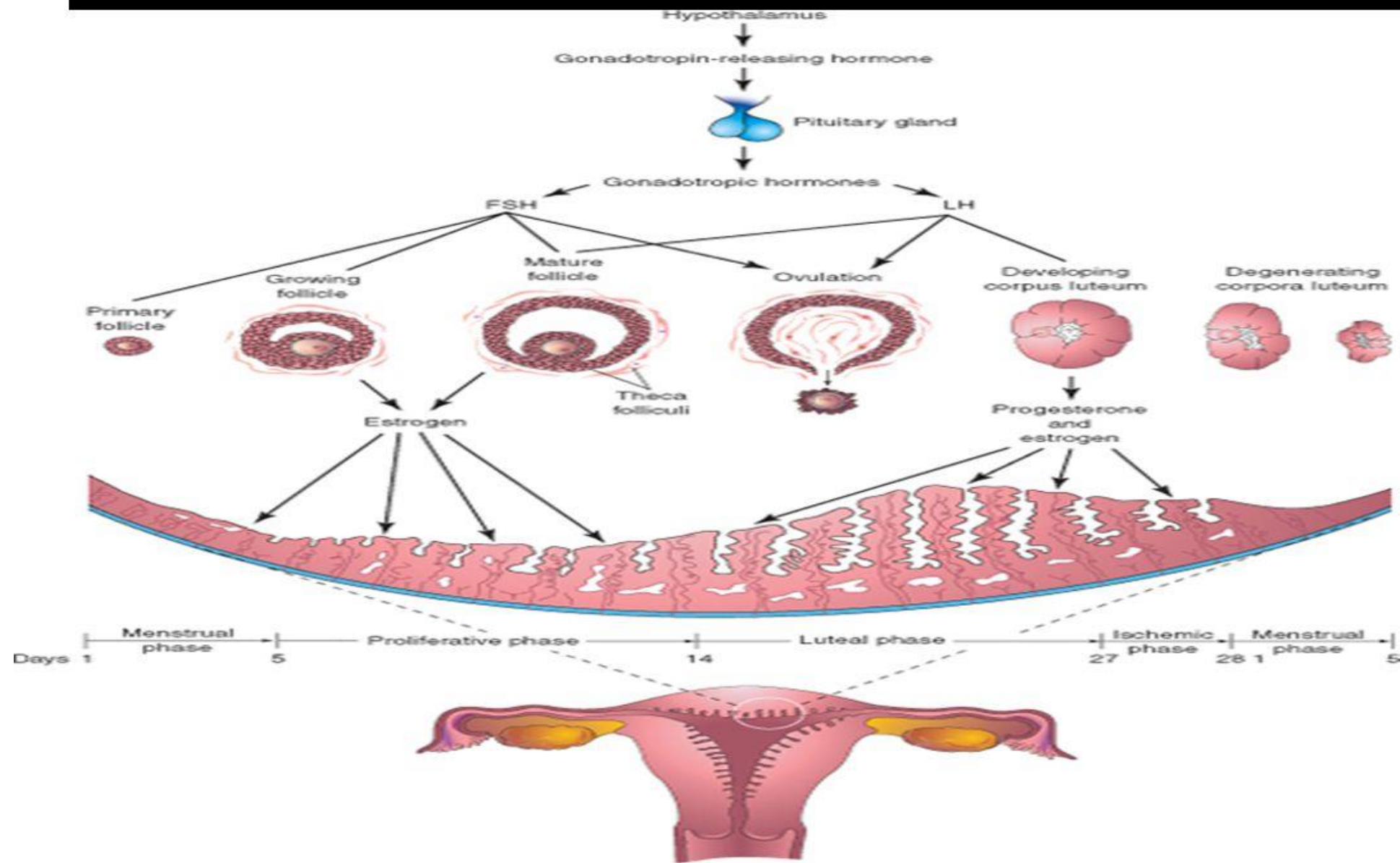
Hormonal control of ovarian cycle

Hormonal control of ovarian cycle continue...

❖ In the middle of the cycle secretion of (F.S.H) stops & the anterior pituitary secrete the luteinizing hormone (L.H) which cause:

1. Ovulation (rupture of mature graafian follicle).
2. Changes of ruptured follicle into corpus luteum.
3. Cause libration of progesterone and small amount of estrogen by corpus luteum.

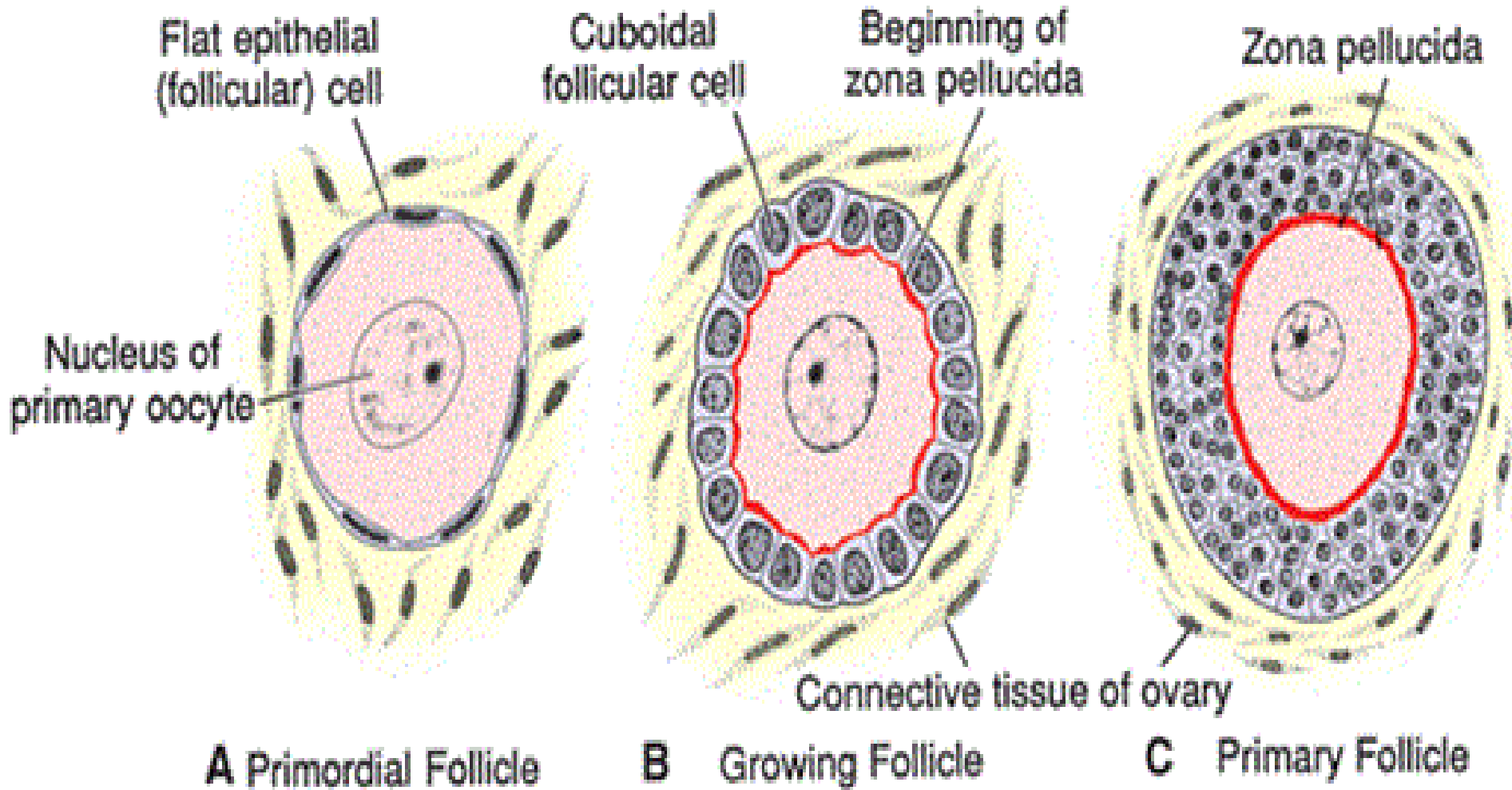
At mid-cycle, there is an **LH surge** that elevates concentrations of maturation promoting factor, causing oocytes to complete meiosis I and initiate meiosis II



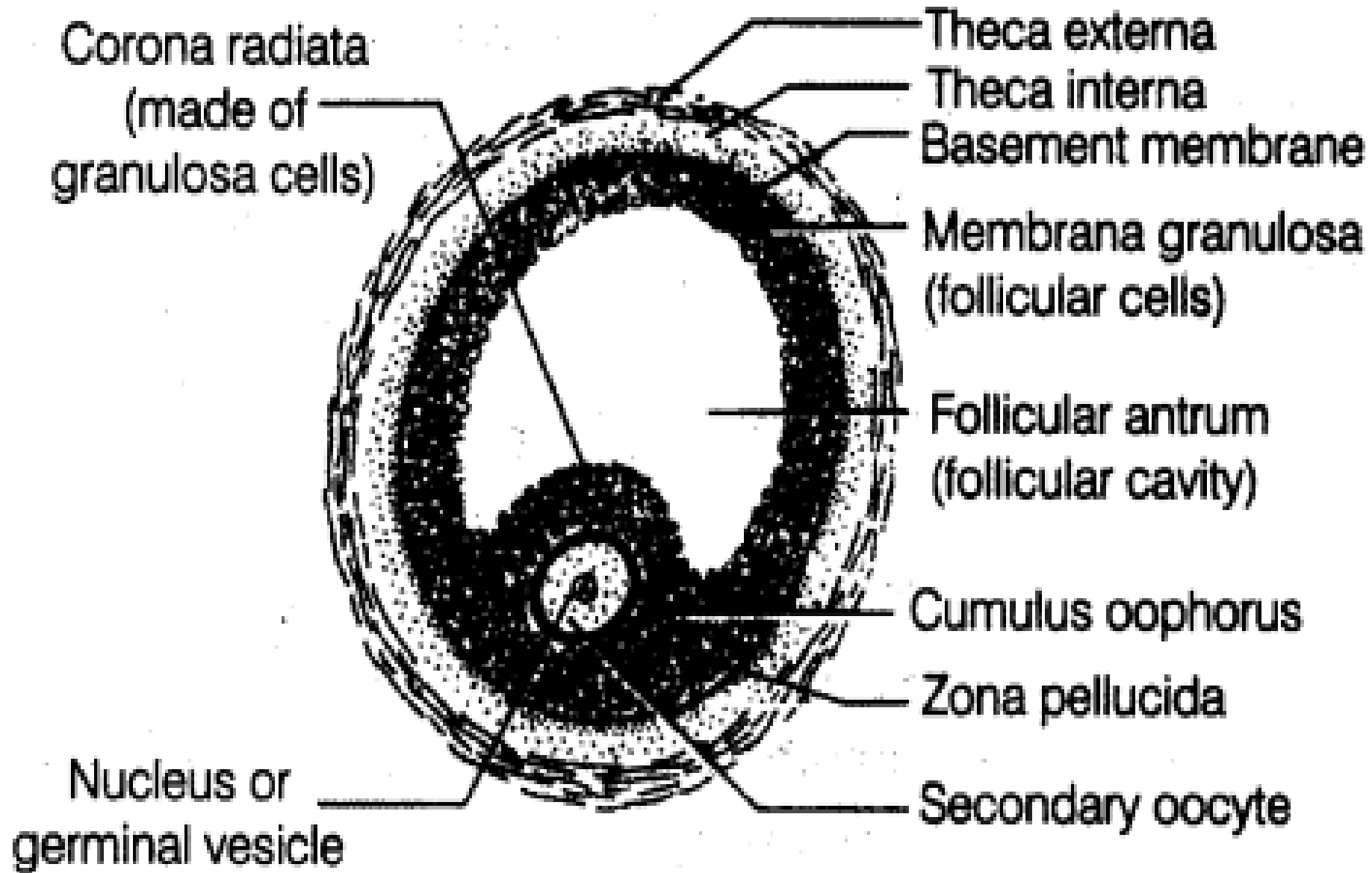
Hormonal control of ovarian cycle

The development of the graafian follicle:

- The cortex of the ovary contains hundreds of thousands of primary follicles.
- The F.S.H of pituitary stimulate a number of primary follicle to develop into mature graafian follicles as follows:
- Under the effect of F.S.H:
 1. The simple flat epithelial cells which surround the primary oocyte become **columnar** and divide forming many layers around oocyte.



The follicular phase



Mature graafian follicle

The development of the graafian follicle continue...

2. The follicular cells deposit a glycoprotein substance which form **zona pellucida** and follicular cell now are called granulosa cells.
3. The follicular cell which is closed to oocyte is called **cumulus oophorus cells**.
4. Small irregular space appear between the granulosa cells form **follicular cavity**.
- This structure called **mature graafian follicle**.

Corpus luteum and its fate:

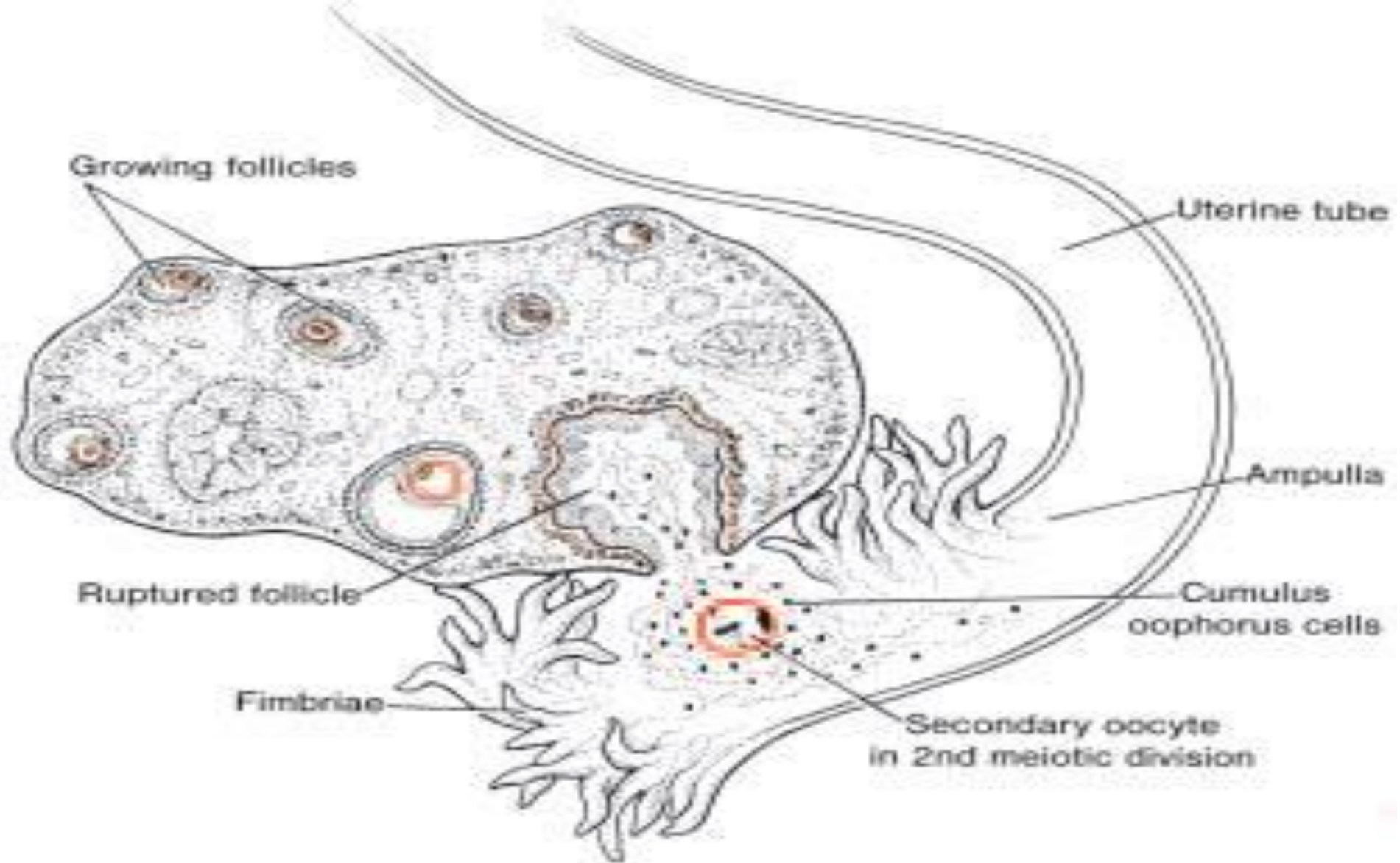
- After ovulation the ruptured follicle is distended with yellow pigment known as **corpus luteum**.
- It reaches its maximum development at 9th day after ovulation. It secretes progesterone and estrogen.

❖ Fate of corpus luteum:

- **If no fertilization occurs**, the corpus luteum persists for 10-14 days, then degenerates & forms a mass of fibrotic scar tissue called **corpus albicans**.

Corpus luteum and its fate continue...

- If fertilization occur, the corpus luteum may persist up to 6 month (usually 4 months) and it enlarges & called **corpus luteum of pregnancy** (corpus luteum graviditatis).
- Degeneration of the corpus luteum is prevented by (hCG), a hormone secreted by the **syncytiotrophoblast** of the developing embryo.
- After 4 month it starts to degenerate and its function being carried by placenta (after 12 weeks the placenta usually over the function).



Ovarian cycle

Thank You