

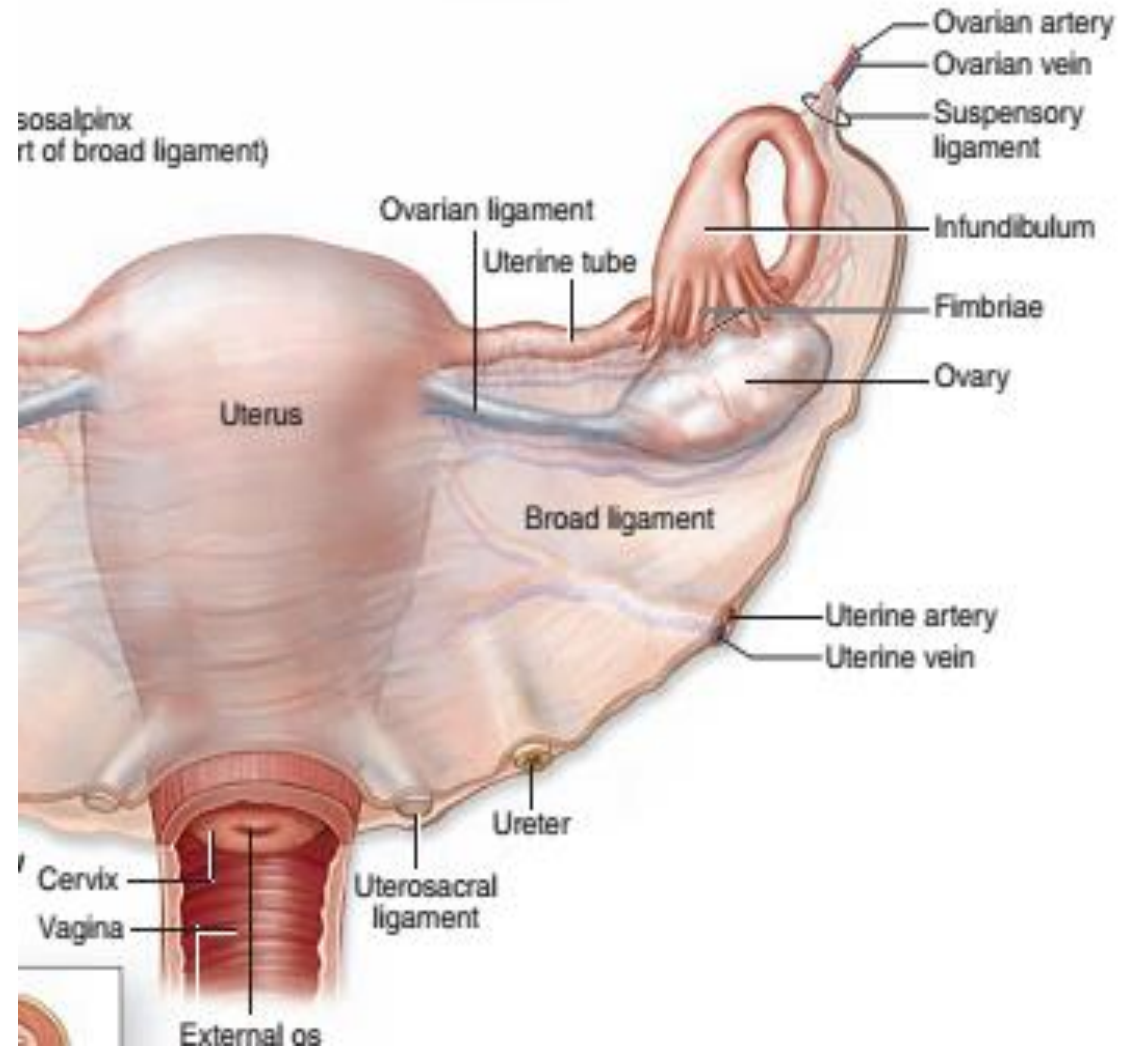
Female Reproductive System

Histology of Ovaries

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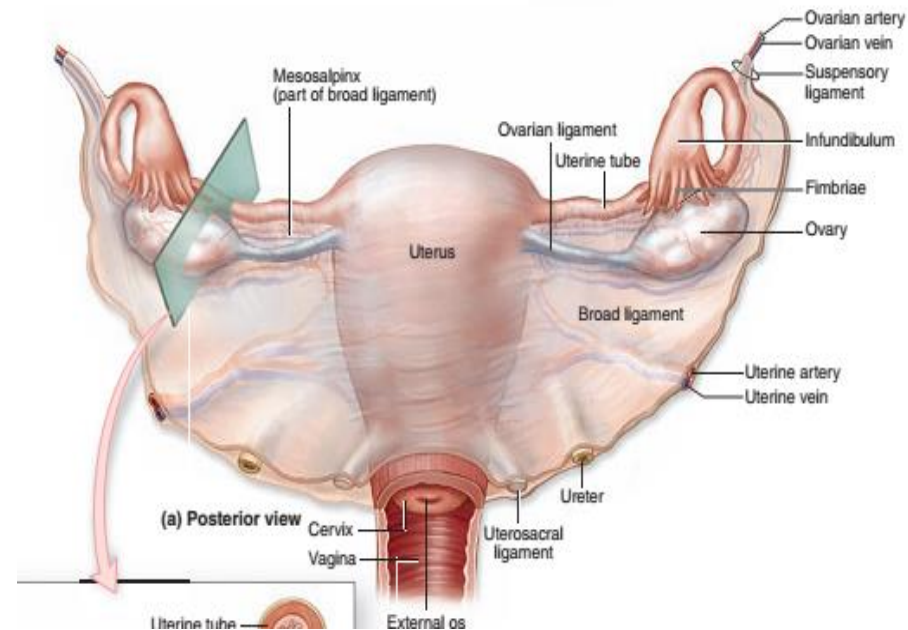
Female Reproductive System

- The female reproductive system consists
 - ❑ Paired ovaries and oviducts (or uterine tubes),
 - ❑ the uterus,
 - ❑ the vagina,
 - ❑ And the external genitalia



Female Reproductive System

- This system produces the female gametes (oocytes),
- Provides the environment for fertilization,
- And holds the embryo through the fetal stage until birth.
- As like male gonads, the ovaries produce steroidal sex hormones
- That control organs of the reproductive system and influence other organs.



Menarche vs Menopause

At Menarche

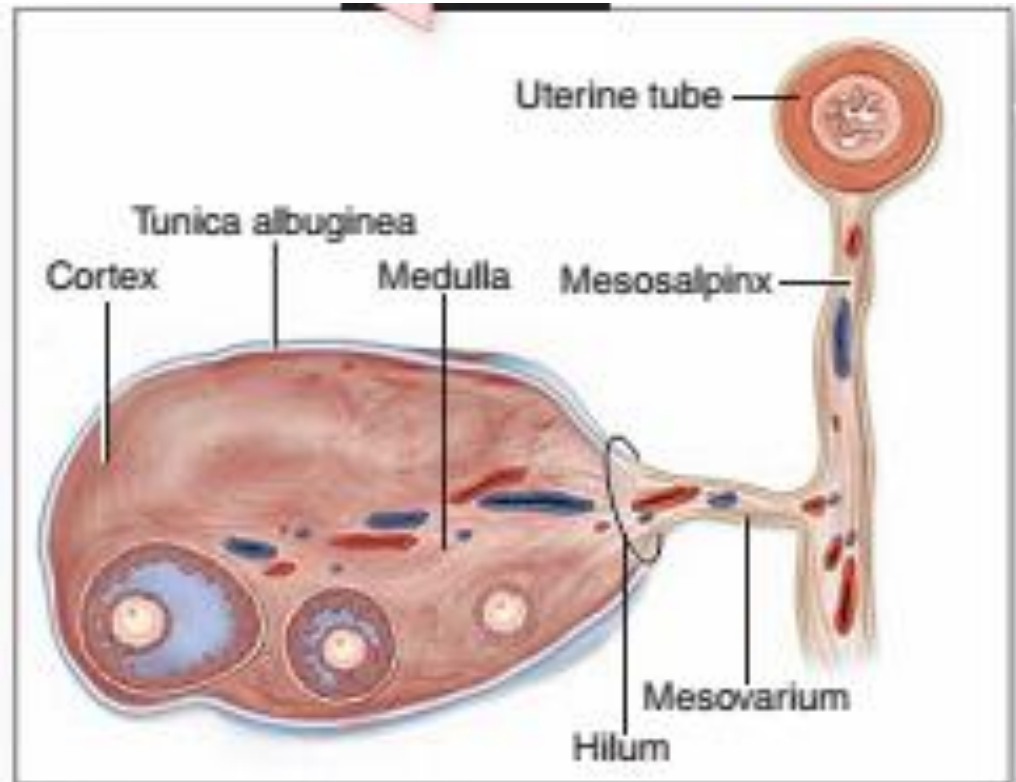
- When the first menses occurs
- The reproductive system undergoes monthly changes in structure and function that are controlled by neurohormonal mechanisms.

At Menopause

- Occur in a variably timed period.
- During which the cyclic changes become irregular and eventually disappear.
- In the postmenopausal period the reproductive organs slowly involute.

Ovaries

- Are almond-shaped bodies
- Approximately 3 cm long
- 1.5 cm wide, and 1 cm thick.
- Covered by a simple cuboidal epithelium
- Overlying a layer of dense connective tissue capsule, the tunica albuginea, like that of the testis.



(b) Lateral sectional view

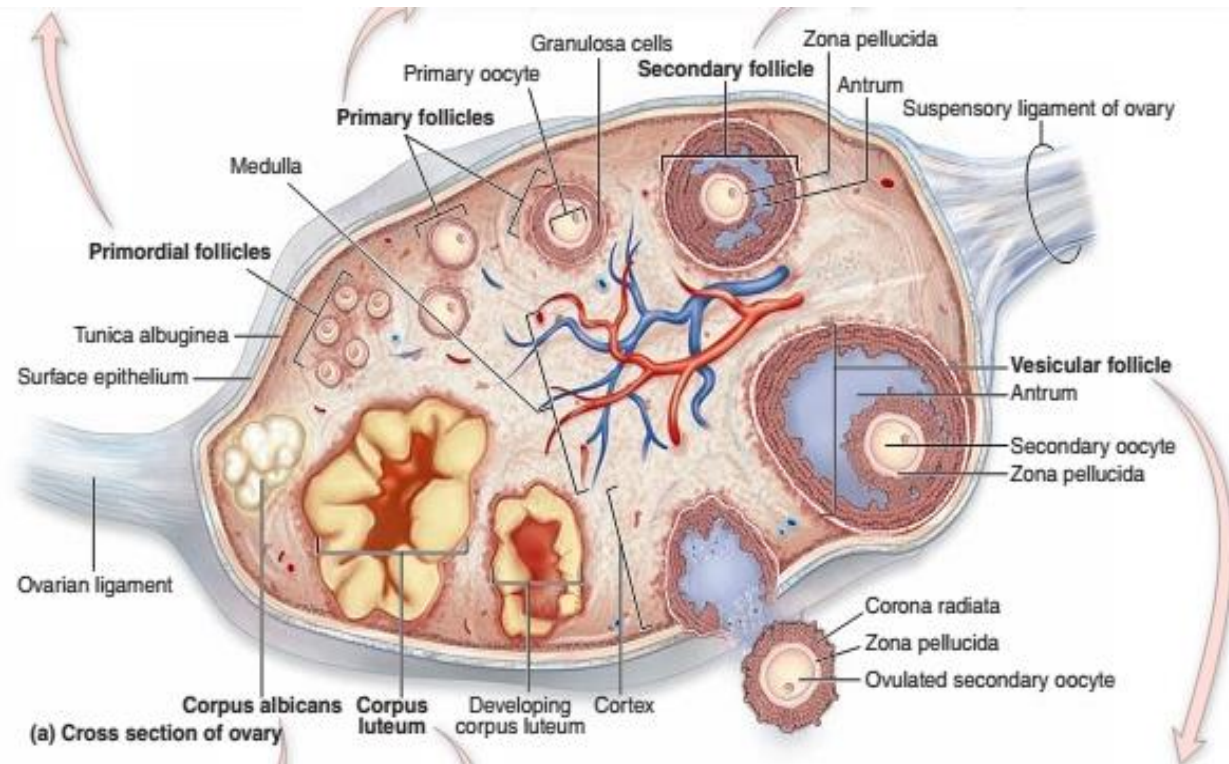
Ovaries

Cortex.

- A region with a stroma of highly cellular connective tissue
- And many ovarian follicles varying greatly in size after menarche.

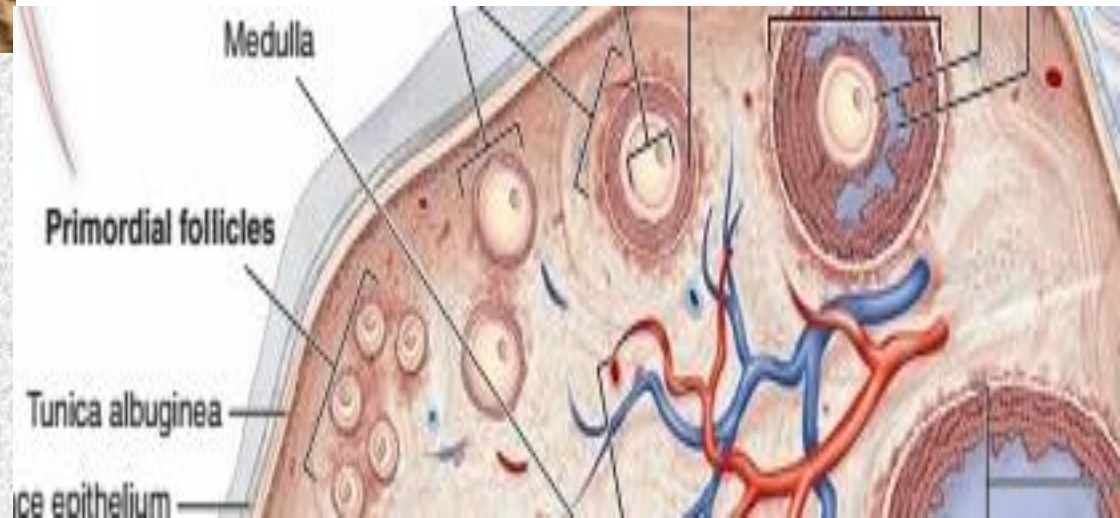
Medulla

- The most internal part of the ovary.
- Contains loose connective tissue
- And blood vessels entering the organ through the hilum .
- There is no distinct border between the ovarian cortex and medulla

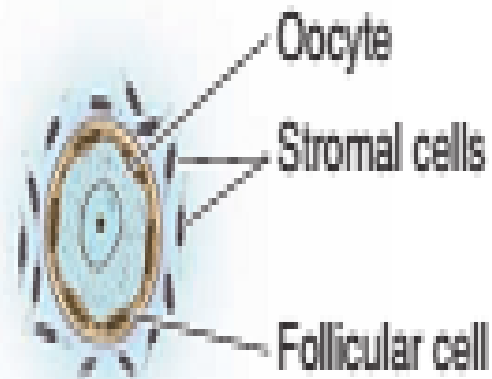


Ovarian Follicles

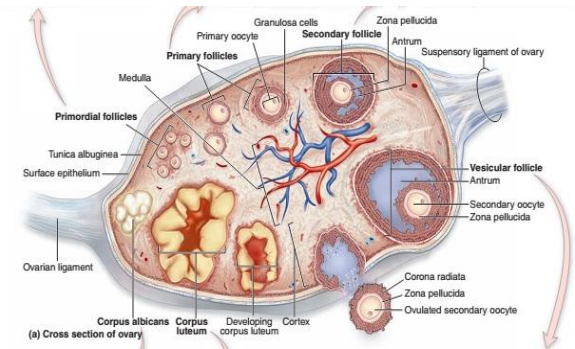
- An ovarian follicle consists of an oocyte
- Surrounded by one or more layers of epithelial cells within a basal lamina.
- The follicles that are formed during fetal life—primordial follicles—



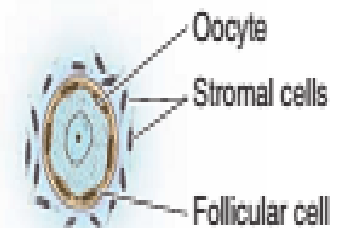
Primordial follicle



Primordial Follicles



Primordial follicle

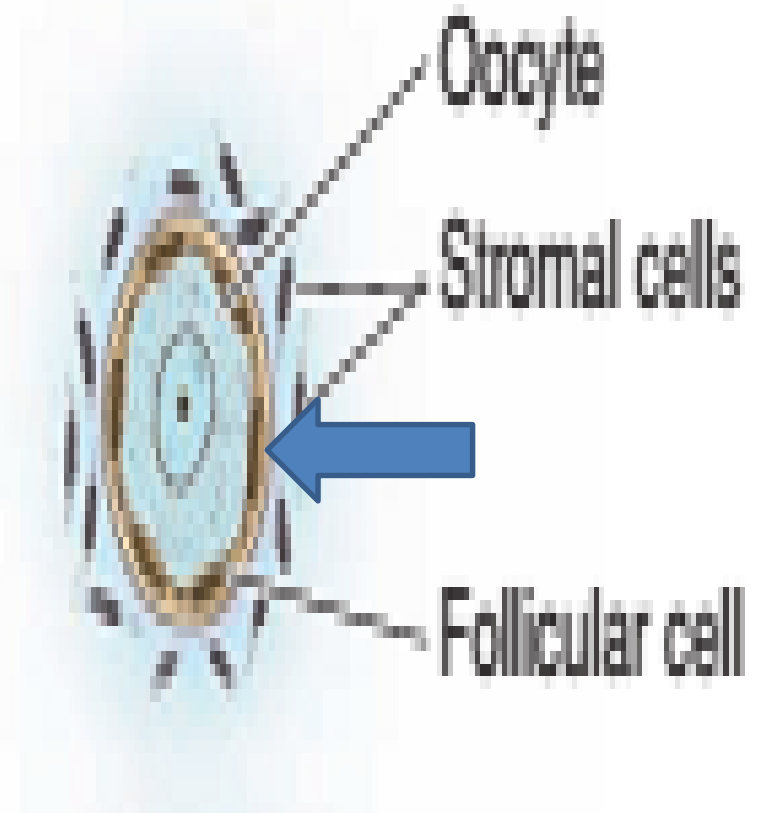


- Consist of a primary oocyte enveloped by a single layer of the flattened follicular cells .
- The oocyte in the primordial follicle is spherical and about 25 μm in diameter
- With a large nucleus containing chromosomes

Primordial Follicles

- Organelles tend to be concentrated near the nucleus.
- Basal lamina surrounds the follicular cells, marking a clear boundary between the follicle and the Vascularized stroma

Primordial
follicle



Follicular Growth & Development

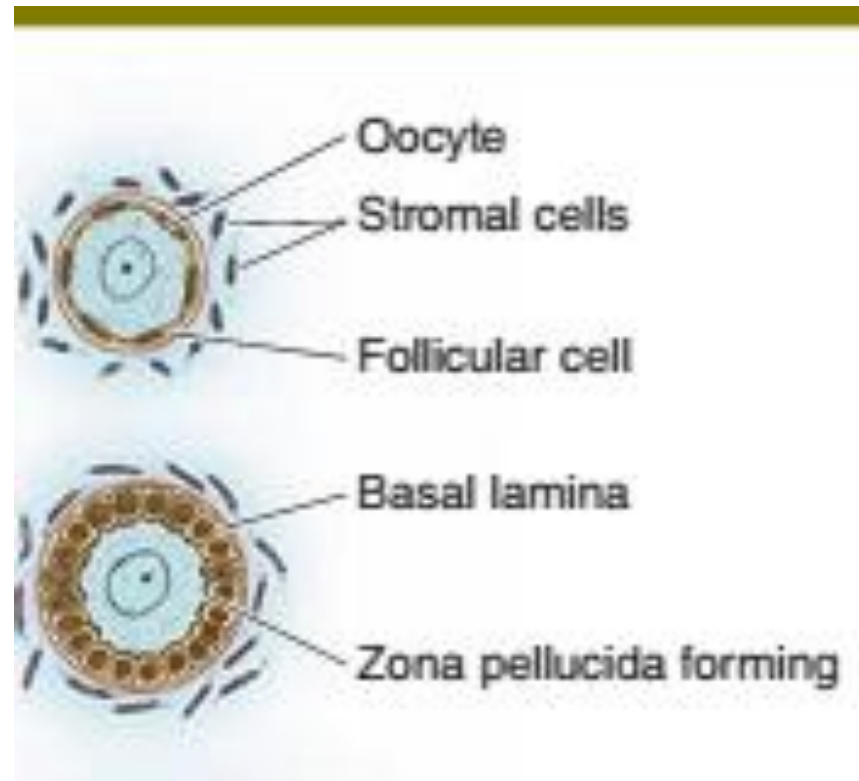
At puberty

with the release of (FSH) from the pituitary

- Primordial follicles begins a process of follicular growth.

This involves

- ✓ Growth of the oocyte,
- ✓ Proliferation and changes in the follicular cells,
- ✓ As well as proliferation and differentiation of the stromal fibroblasts around each follicle.
- Selection of the primordial follicles that undergo growth and recruitment involve
 - FSH receptor numbers
 - Aromatase activity
 - Estrogen synthesis, and other variables.



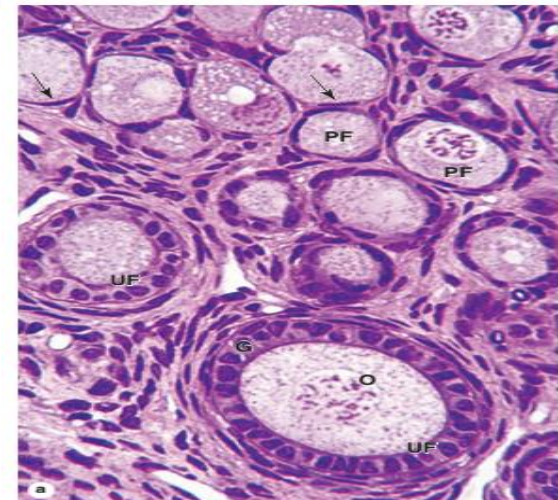
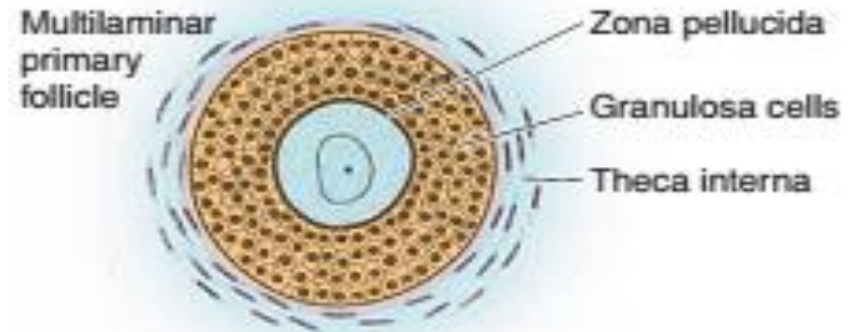
Follicular Growth & Development

Unilaminar primary follicle .

- ❖ Follicular cells undergo mitosis
- ❖ and form a simple cuboidal epithelium
- ❖ Now called a unilaminar primary follicle .

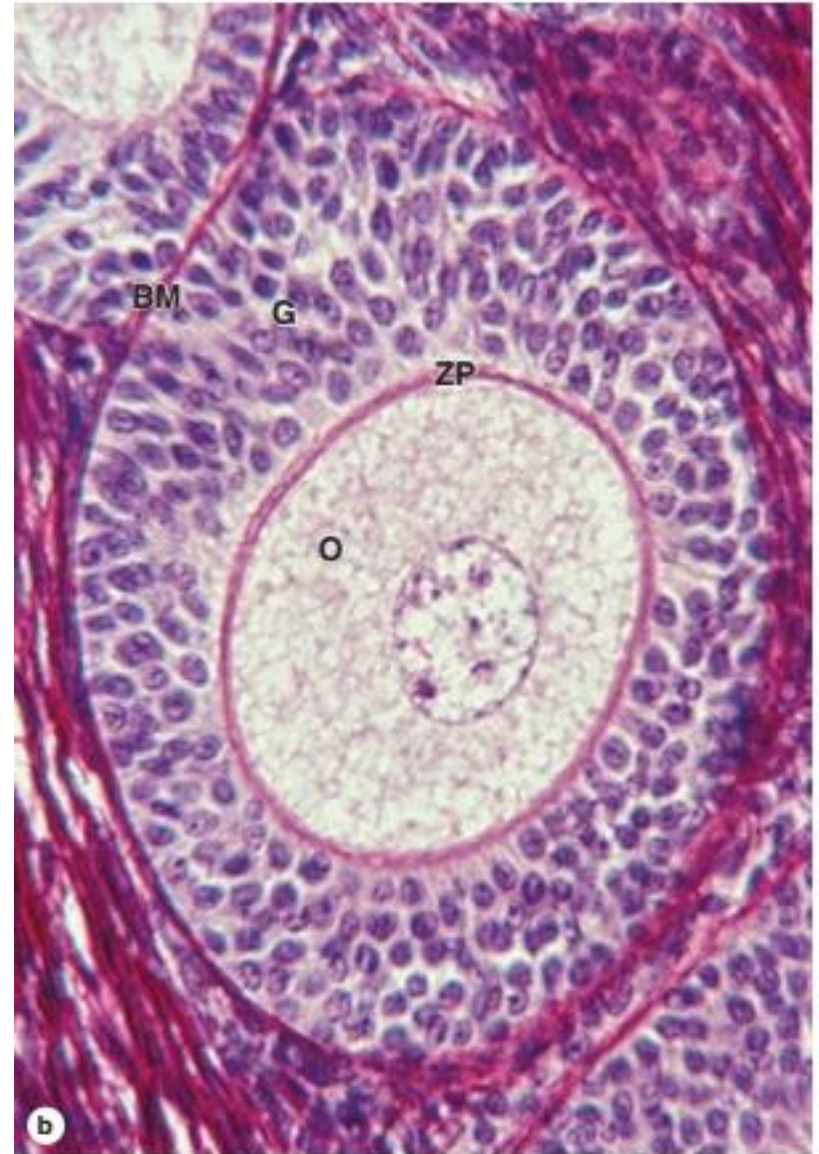
Multilaminar primary follicle.

- The follicular cells continue to proliferate,
- Forming a stratified follicular epithelium, the granulosa,
- In which the cells communicate through gap junctions.
- Follicular cells are now termed granulosa cells
- And the follicle is a multilaminar primary follicle still surrounded by a basement membrane .



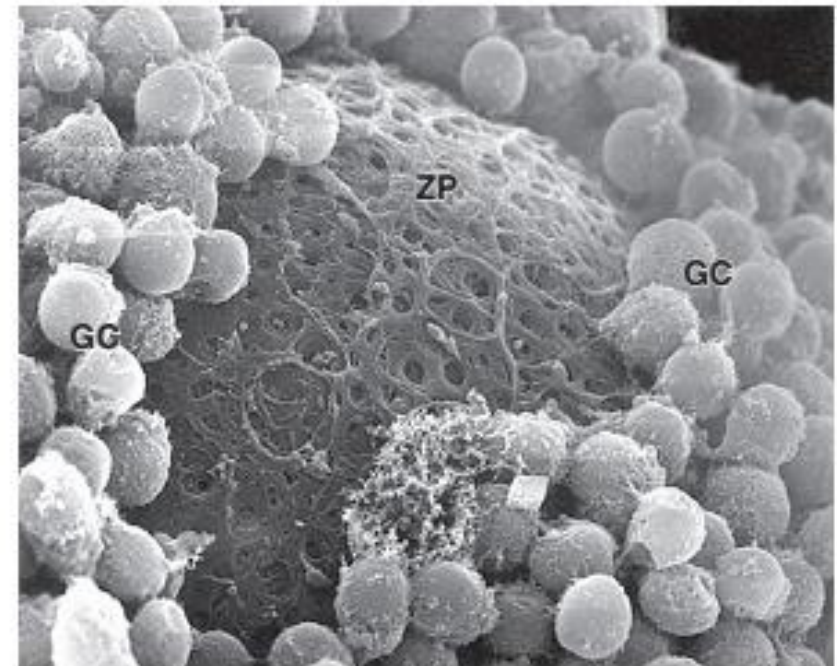
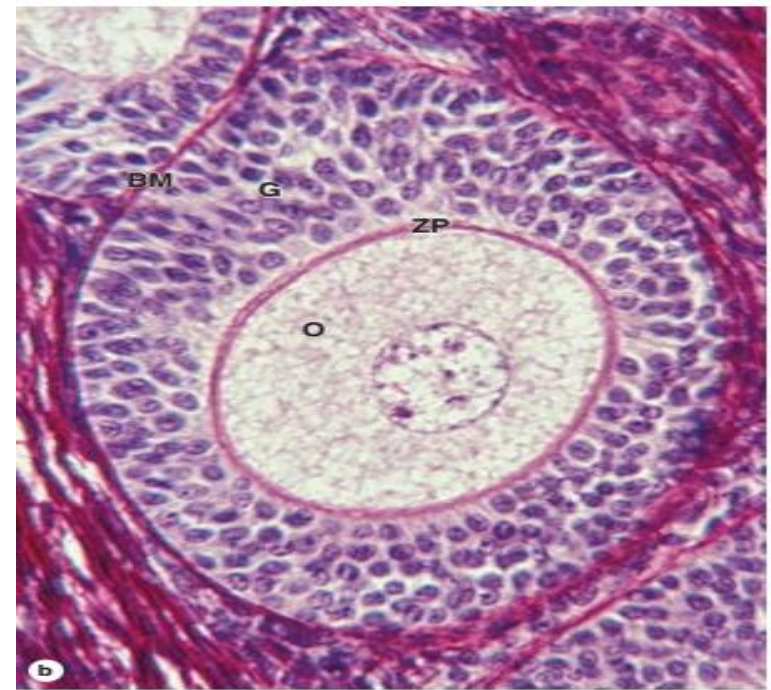
Zona Pellucida

- ❑ Between the oocyte and the first layer of granulosa cells of the growing primary follicle.
- ❑ Extracellular material accumulates as the zona pellucida.
- ❑ 5 to 10 μm thick
- ❑ Containing four glycoproteins secreted by the oocyte .



Zona Pellucida

- The zona pellucida components ZP3 and ZP4 are important sperm receptors.
- Binding specific proteins on the sperm surface
- Inducing acrosomal activation.
- Filopodia of granulosa cells and microvilli of the oocyte penetrate the zona pellucida, allowing communication between these cells via gap junctions



Follicular Theca

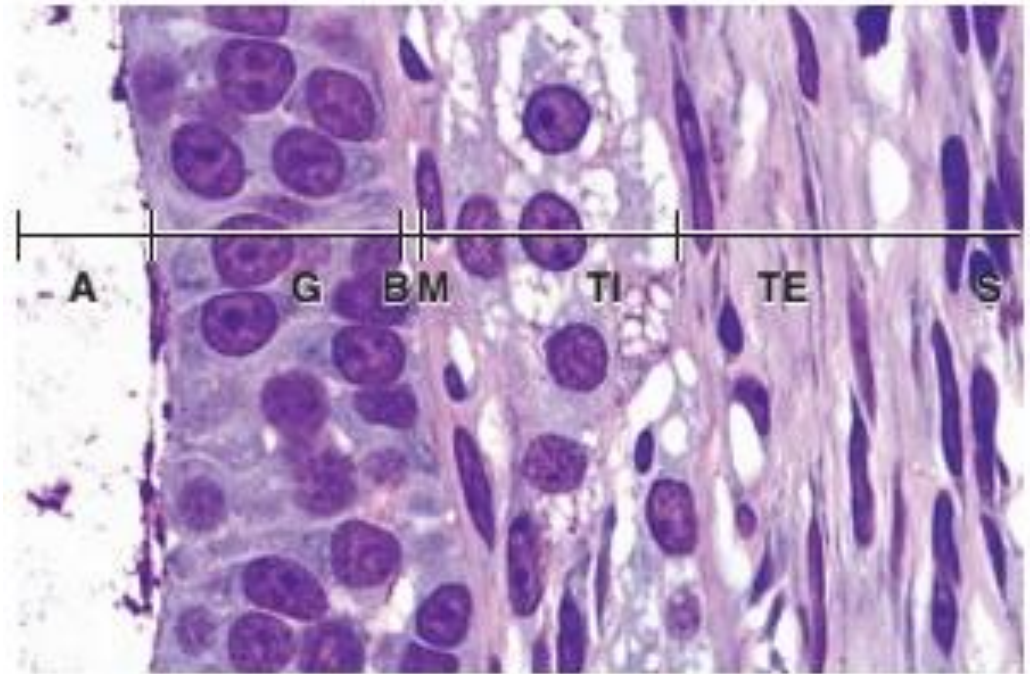
- Stromal cells differentiate to form the follicular theca
- Further as two distinct tissues around the follicle

Theca interna

- ❑ A well-vascularized endocrine tissue
- ❑ Typical steroid-producing cells secreting Androstenedione.

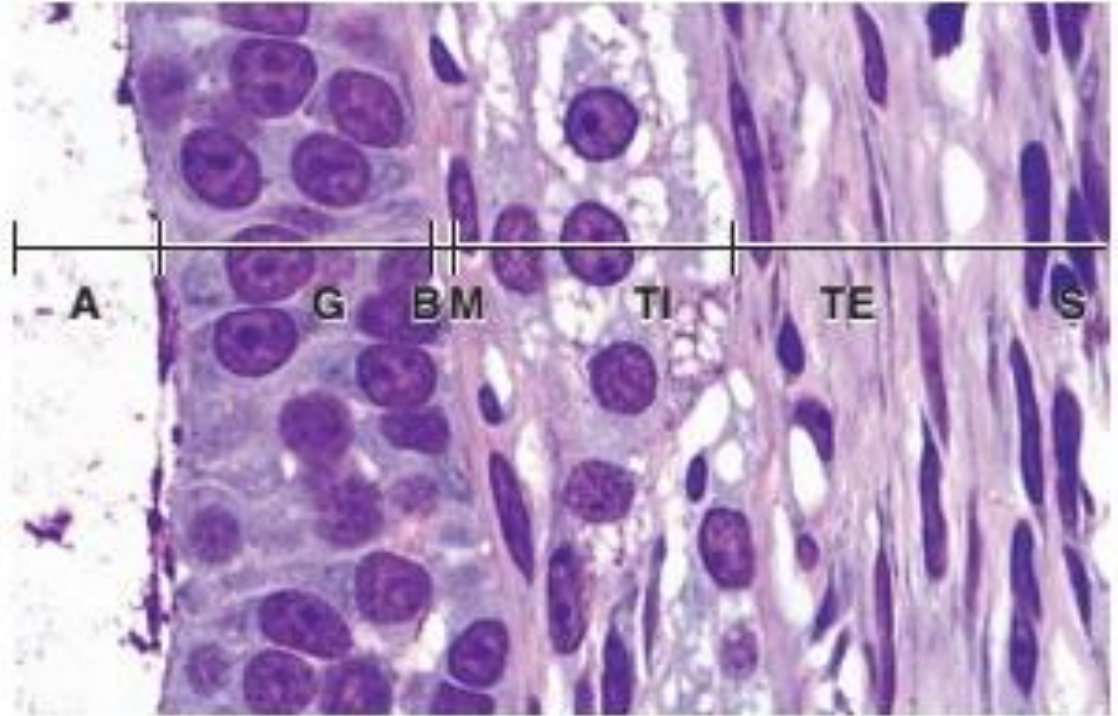
➤ Theca externa

- ❑ A more fibrous
- ❑ With fibroblasts and smooth muscle merges gradually with the surrounding stroma.



Theca Interna

- With typical steroid-producing cells secreting Androstenedione.
- ❑ This precursor molecule diffuses into the follicle through the basement membrane
- ❑ And in the granulosa cells the enzyme aromatase converts it to estradiol
- ❑ An FSH-dependent function.
- ❑ This estrogen returns to the thecae and stroma around the follicle, enters capillaries, and is distributed throughout the body.

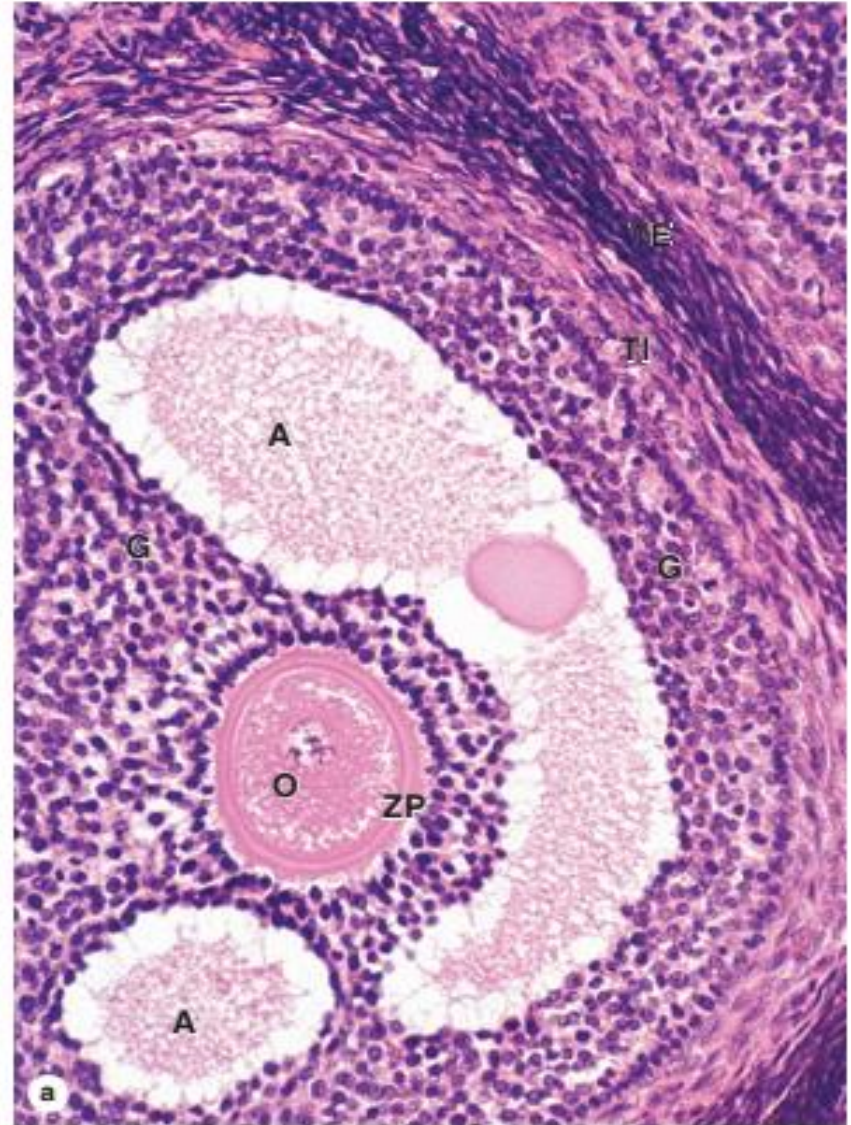


Vesicular or Antral follicles.

- ❑ Small spaces appear between the granulosa layers
- ❑ As the cells secrete follicular fluid (or liquor folliculi).
- ❑ The spaces enlarge and gradually
- ❑ The granulosa cells reorganize themselves around a larger cavity called the antrum

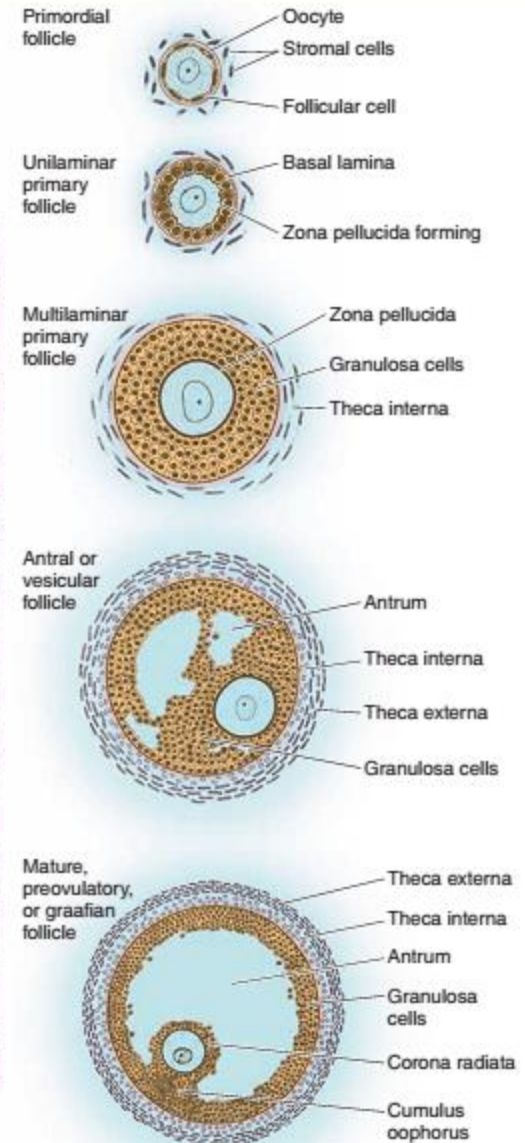
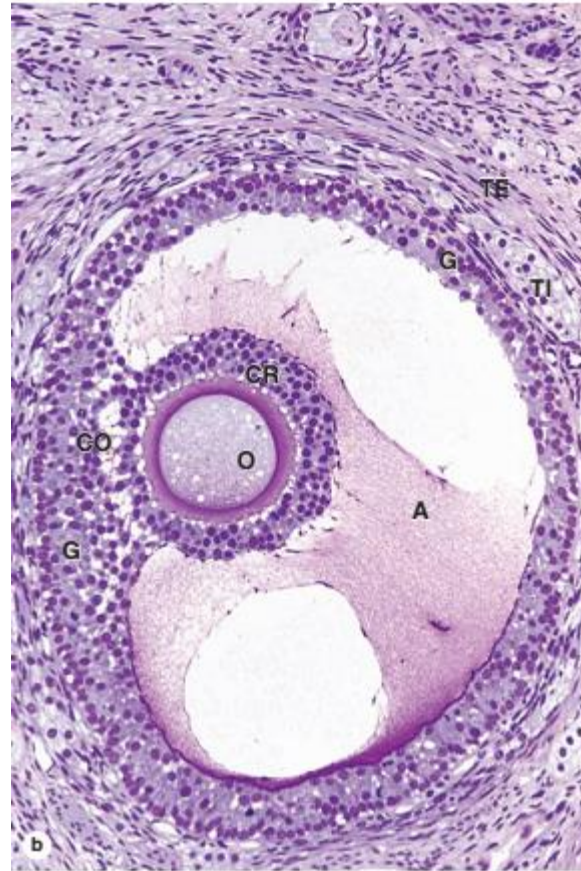
- ❑ Producing follicles now called vesicular or antral follicles.

- ❑ Follicular fluid contains
 - ❖ the large GAG hyaluronic acid
 - ❖ growth factors
 - ❖ plasminogen



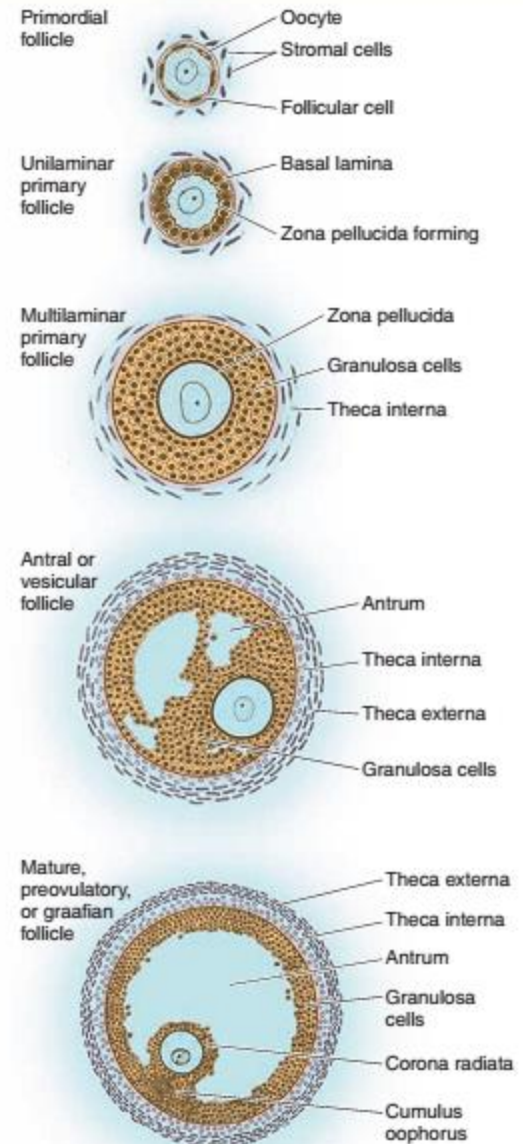
Cumulus Oophorus

- As the antrum develops, the granulosa cells around the oocyte form a small stem, the cumulus oophorus, which protrudes into the antrum.
- Those granulosa cells that immediately surround the zona pellucida make up the corona radiata and accompany the oocyte
- It leaves the ovary at ovulation.



Graafin follicle

- The single large antrum of a mature or preovulatory follicle (or graafin follicle)
- Accumulates follicular fluid rapidly and expands to a diameter of 2 cm or more.
- A preovulatory follicle forms a bulge at the ovary surface visible with ultrasound imaging.
- The granulosa layer becomes thinner at this stage
- Because its cells do not multiply in proportion to the growth of the antrum.

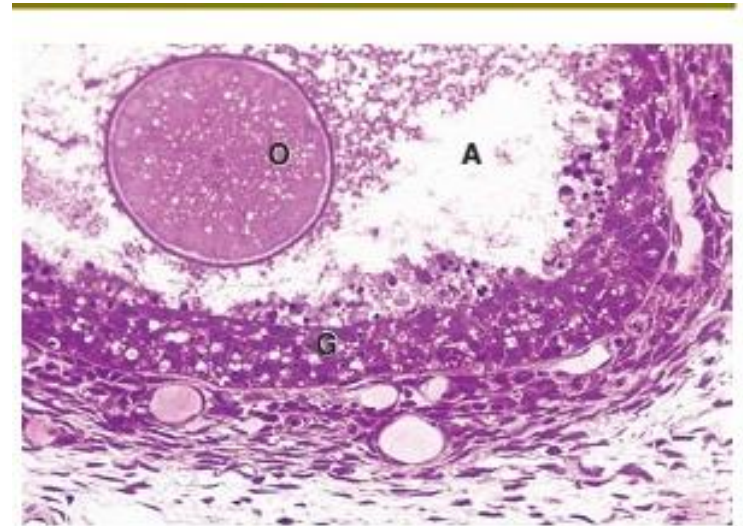


Follicular Atresia

- Most ovarian follicles undergo the degenerative process called atresia,
- Follicular cells and oocytes die
- Disposed of by phagocytic cells.
- Follicles at any stage of development, including nearly mature follicles, may become atretic .

Atresia involves

- Apoptosis and
 - Detachment of the granulosa cells,
 - Autolysis of the oocyte, and
 - Collapse of the zona pellucida.
-
- Early in this process, macrophages invade the degenerating follicle and phagocytose



Follicular Atresia

During a typical menstrual cycle

- One follicle becomes dominant and develops farther than the others.
- The dominant follicle usually reaches the most developed stage of follicular growth and undergoes ovulation.
- while the other primary and antral follicles undergo atresia.
- The large growing follicles produce much estrogen before becoming atretic follicles each month.
- This estrogen stimulates preparation of the reproductive tract to transport and sustain the embryo if the oocyte from the dominant follicle is fertilized.

MEDICAL APPLICATION

- **Late primary or antral follicles** can produce follicular cysts
- which are thin-walled, fluid-filled structures with both granulosa and thecal endocrine cells.
- **Follicular cysts are common and usually benign,**
- But can produce high estrogen levels and lead to menstrual irregularities.
- if cyst formation disrupts blood vessels blood enters the fluid, often rapidly, and produces a **hemorrhagic cyst.**

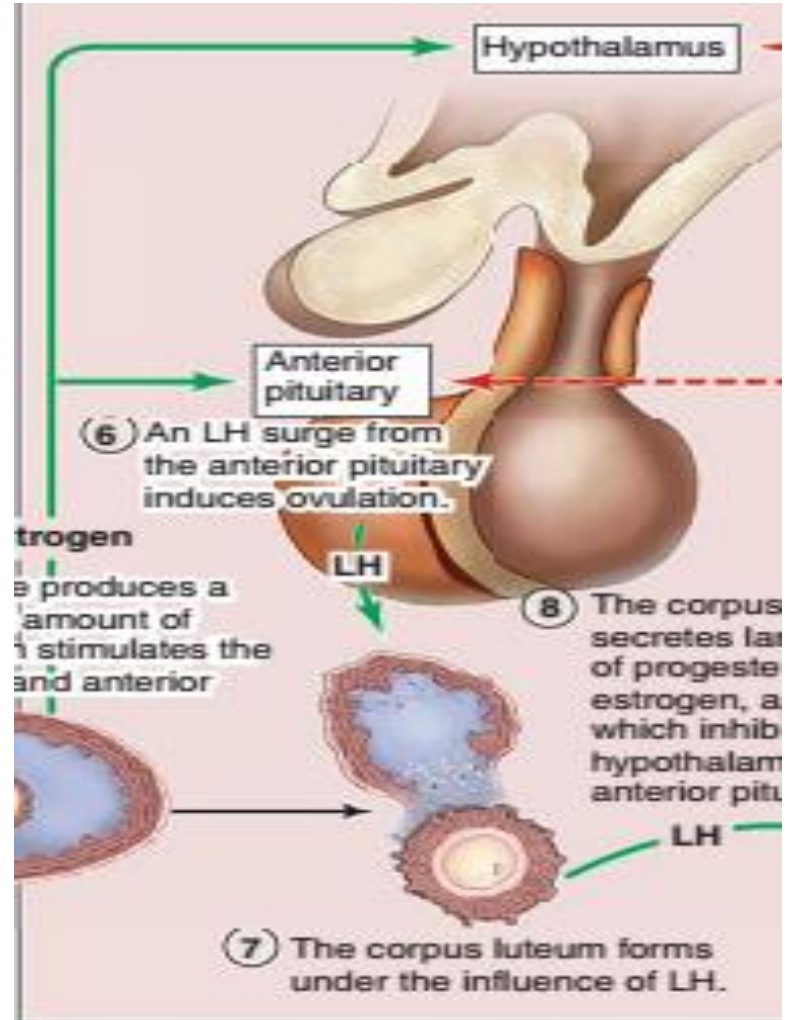
Ovulation

- Is the hormone-stimulated process
- By which the oocyte is released from the ovary.
- Occurs midway through the menstrual cycle
- That is, around the 14th day of a typical 28-day cycle.

Ovulation & Stigma Formation

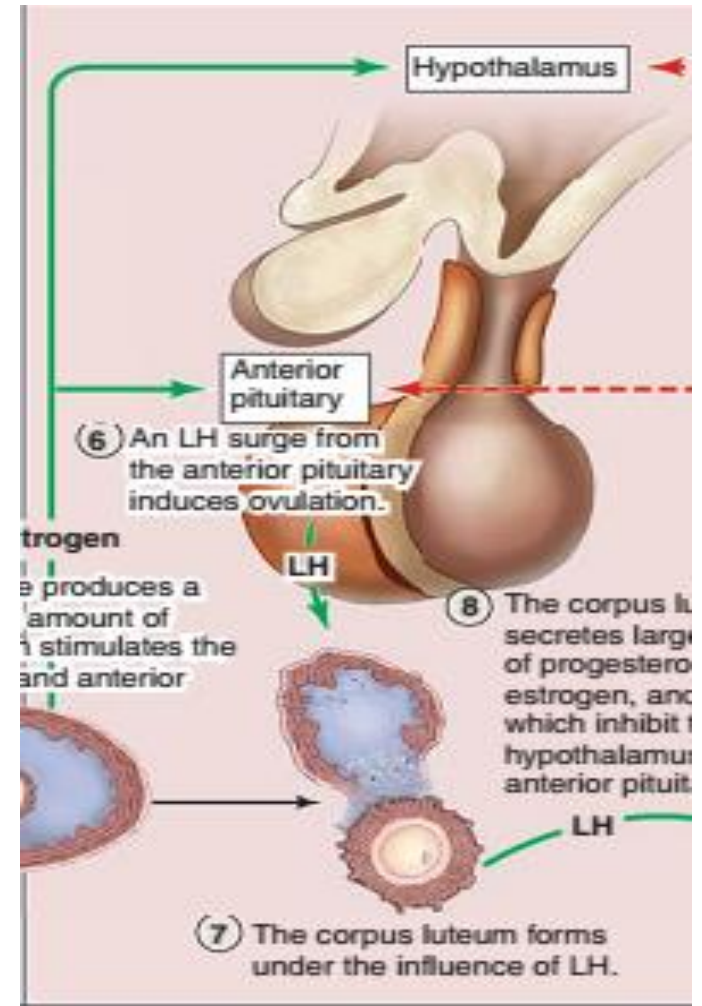
Before ovulation

- Mature dominant follicle bulging against the tunica albuginea
- Develops a whitish or translucent ischemic area the stigma
- In which tissue compaction has blocked blood flow. In humans usually only one oocyte is liberated during each cycle,
- Weakening of the wall lead to rupture of the ovarian surface at the stigma.



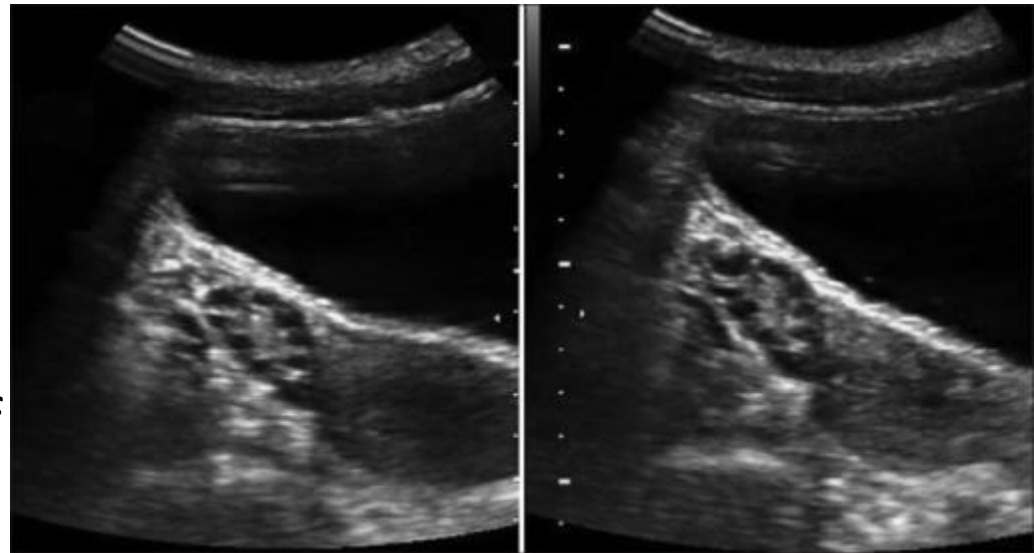
Ovulated Secondary Oocyte

- The oocyte and corona radiata, along with follicular fluid, are expelled by the local smooth muscle contractions.
- Is drawn into the opening of the uterine tube
- Where fertilization may occur.



Polycystic ovary syndrome (PCOS)

- Is a hormonal disorder common among women of reproductive age.
- Women with PCOS may have infrequent or prolonged menstrual periods or excess male hormone (androgen) levels.
- The **ovaries** may develop numerous small collections of fluid (follicles) and fail to regularly release eggs.



Ultrasound of Ovaries



Normal Ovary



PCOS Ovary

Signs and symptoms of PCOS

- **Irregular periods.** Infrequent, irregular or prolonged menstrual cycles are the most common sign of PCOS. For example, you might have fewer than nine periods a year, more than 35 days between periods and abnormally heavy periods.
- **Excess androgen.** Elevated levels of male hormone may result in physical signs, such as excess facial and body hair (hirsutism), and occasionally severe acne and male-pattern baldness.
- PCOS signs and symptoms are typically more severe if you're obese.
- Depression, anxiety and eating disorders

- **Blood tests.** Your blood may be analyzed to measure hormone levels. This testing can exclude possible causes of menstrual abnormalities or androgen excess that mimics PCOS. You might have additional blood testing to measure glucose tolerance and fasting cholesterol and triglyceride levels.
- **An ultrasound.** Your doctor checks the appearance of your ovaries and the thickness of the lining of your uterus.

Treatment

- **Lifestyle changes**
- Your doctor may recommend weight loss through a low-calorie diet combined with moderate exercise activities. — might improve your condition.
- **Medications**
- To regulate your menstrual cycle, your doctor might recommend:

Combination birth control pills.

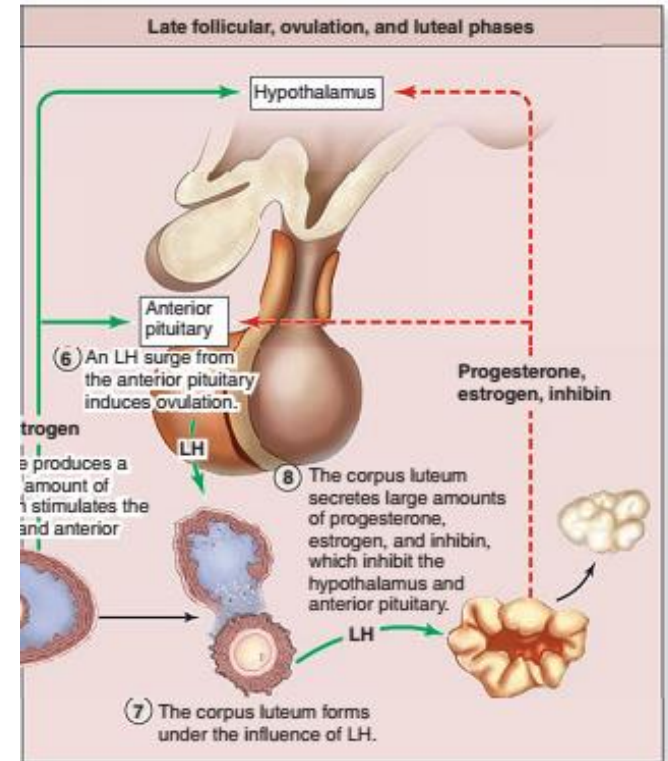
- Pills that contain estrogen and progestin decrease androgen production and regulate estrogen.

Metformin (Glucophage).

This oral medication for type 2 diabetes improves insulin resistance and lowers insulin levels. metformin can also slow the progression to type 2 diabetes and help with weight loss.

Corpus luteum

- If not fertilized within about 24 hours,
- The secondary oocyte begins to degenerate.
- Cells of the ovulated follicle that remain in the ovary re differentiate under the influence of LH and give rise to the corpus luteum .





Thank ALLAH!