



University of Basra  
College of medicine

# The female Reproductive System

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## Reference

. JUNQUERIRAs basic histology

## Lecture objectives:

.Histology of the ovary, uterus, uterine tubes, vagina  
,external genitalia and breast.

.Types and development of ovarian follicles.

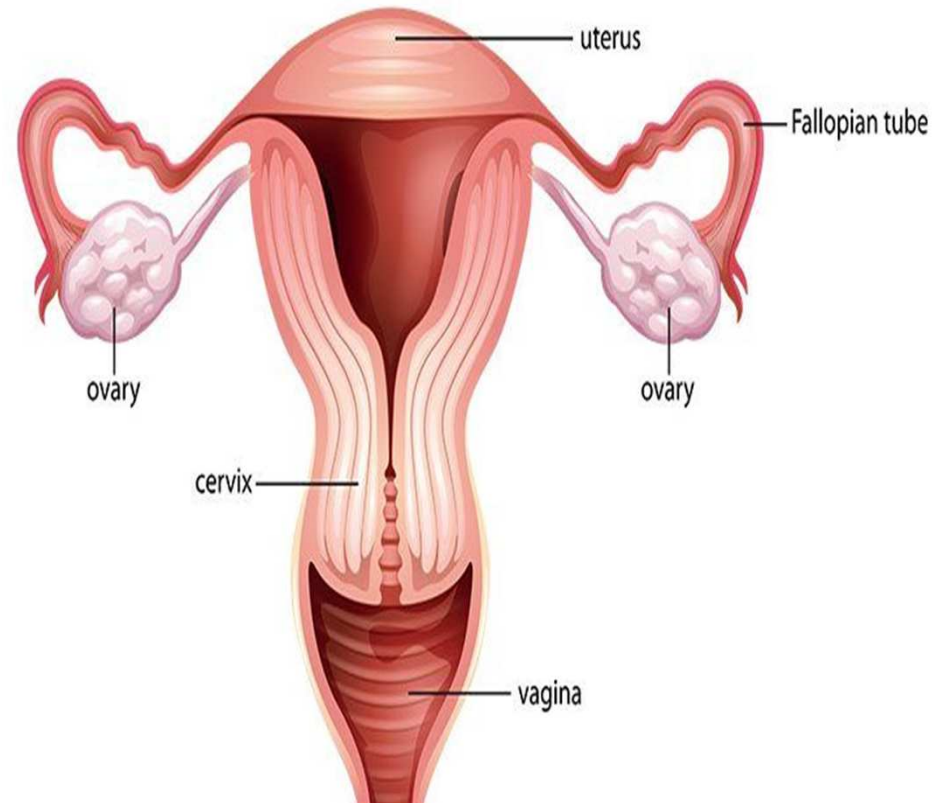
.Ovulation and menstrual cycle.

. Histological changes in the inactive, active and  
lactating breast.

- The **Female reproductive system**

consists of:

1. Paired ovaries and oviducts (uterine tubes)
2. The uterus
3. The vagina
4. The external genitalia



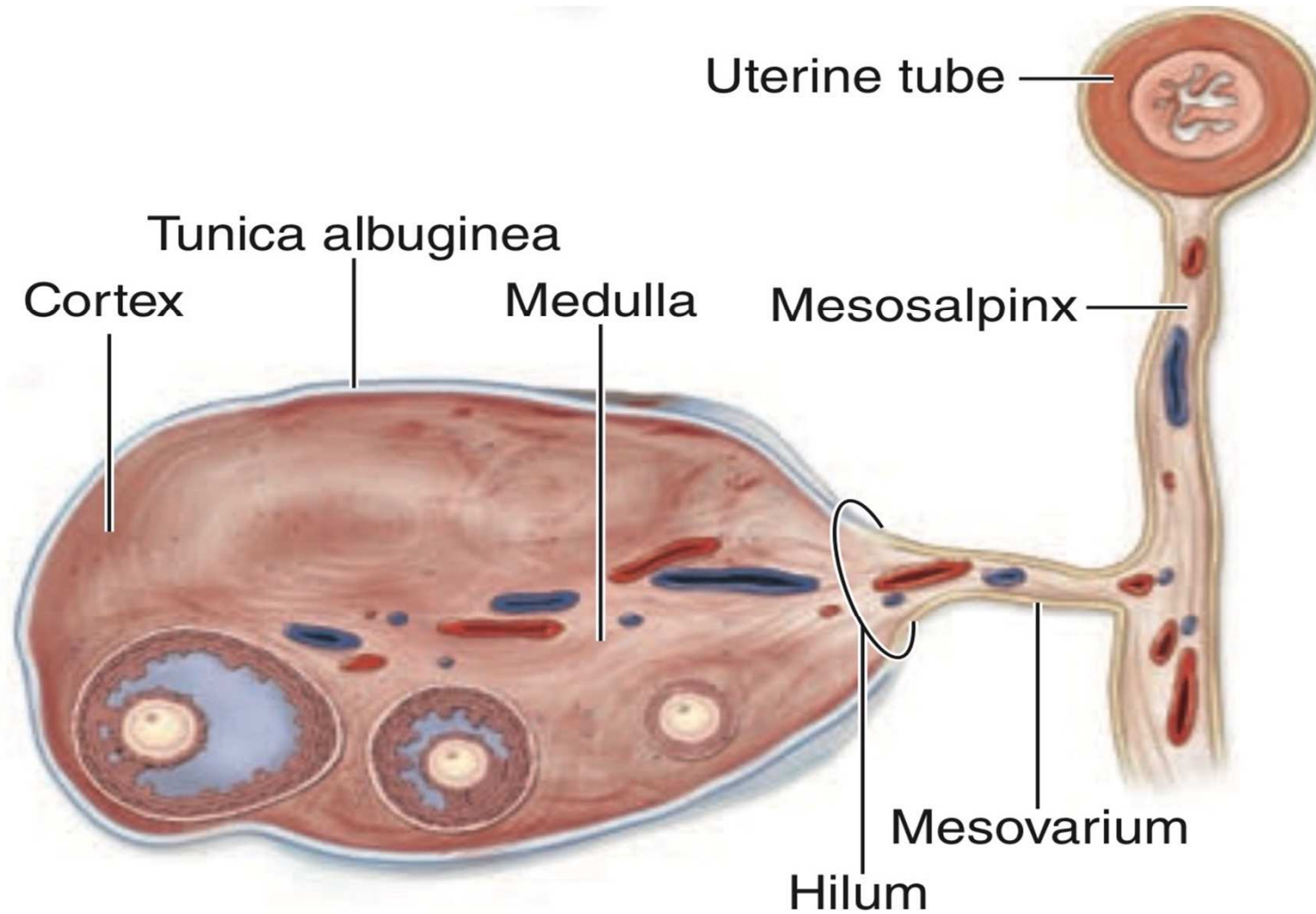
## . **The function:**

1. Production of oocytes.
2. Provide a suitable environment for fertilization.
3. Holds the embryo during its development.
4. Production of sex hormones.

# 1.The Ovaries:

- .Paired almond shaped bodies of an approximately 3 cm long, 1.5 cm width and 1 cm in thickness
- . Each ovary is covered by simple cuboidal epithelium that overly a layer of dense connective tissue capsule (**tunica albuginea**)
- . Most of the ovary consists of a **cortex** ( highly cellular connective tissue + ovarian follicles)
- . The most internal part of the ovary is the **medulla** ( loose connective tissue + blood vessels)

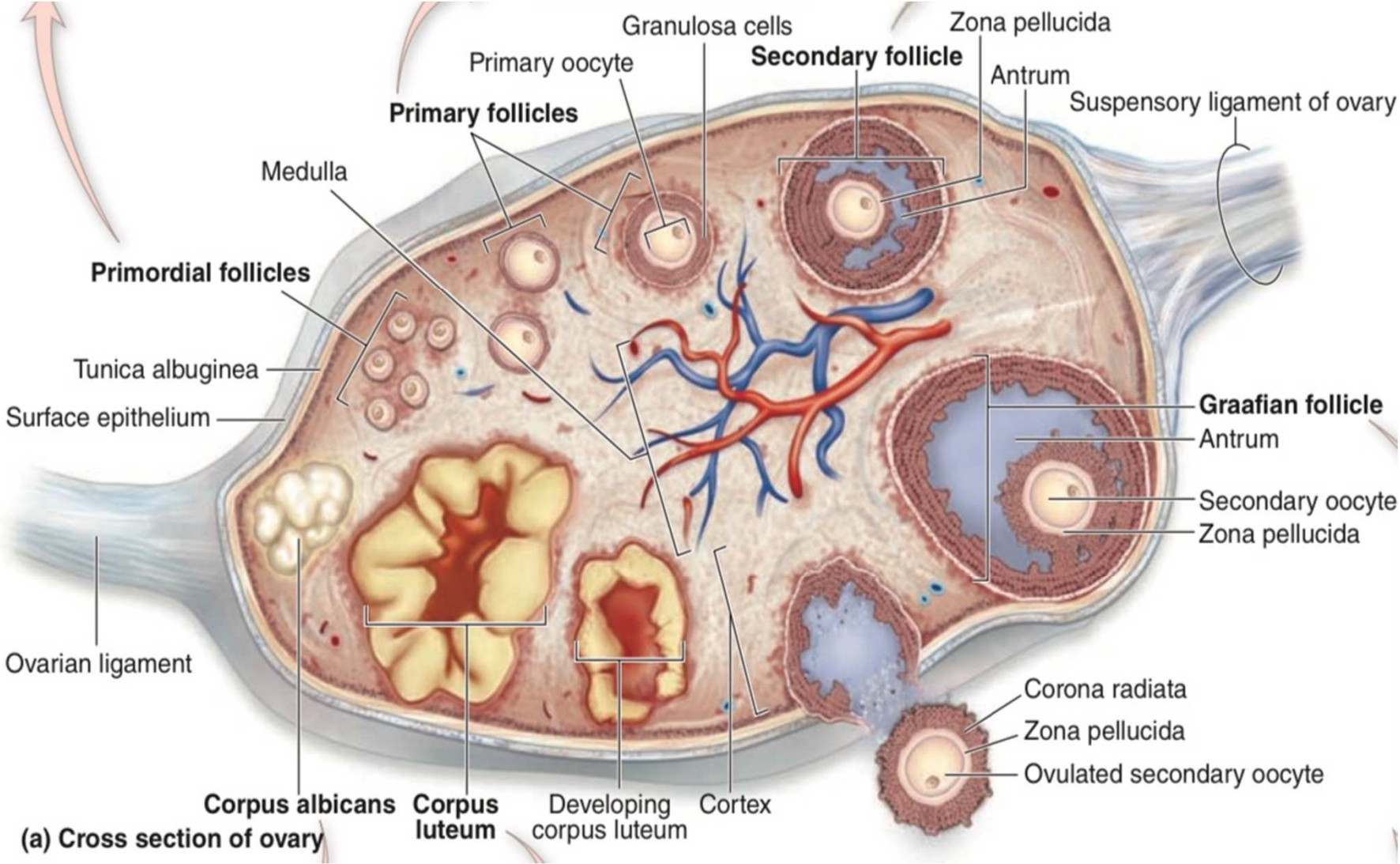
## Lateral sectional view of the ovary



# The Ovarian follicles

- .The ovarian follicle consists of an oocyte surrounded by one or more layers of epithelial cells within a basal lamina.
- .The ovarian follicles that are formed during the fetal life – the **primordial follicles**- consists of a primary oocyte ( of 25  $\mu\text{m}$  in diameter with a large nucleus arrested at the first meiotic prophase) enveloped by a single layer of flattened follicular cells , these are located at the superficial ovarian cortex .

# Follicular development within the ovary

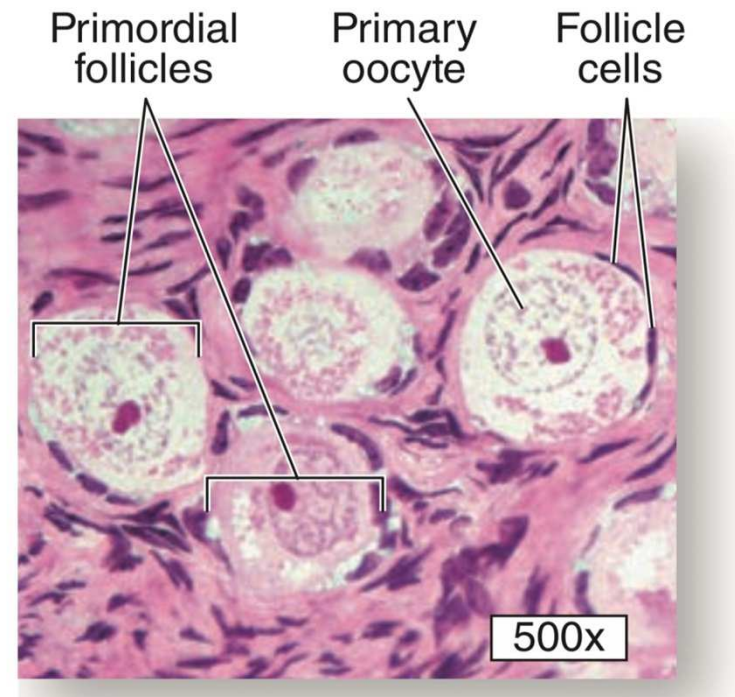


# Follicular growth and development

- .At puberty the release of follicular stimulating hormone( **FSH**) from the pituitary gland, a small group of primordial follicles each month begins a process of follicular growth
- . Promoted by FSH , an oocyte grows rapidly during the first part of follicular development , reaching a diameter of 120  $\mu\text{m}$

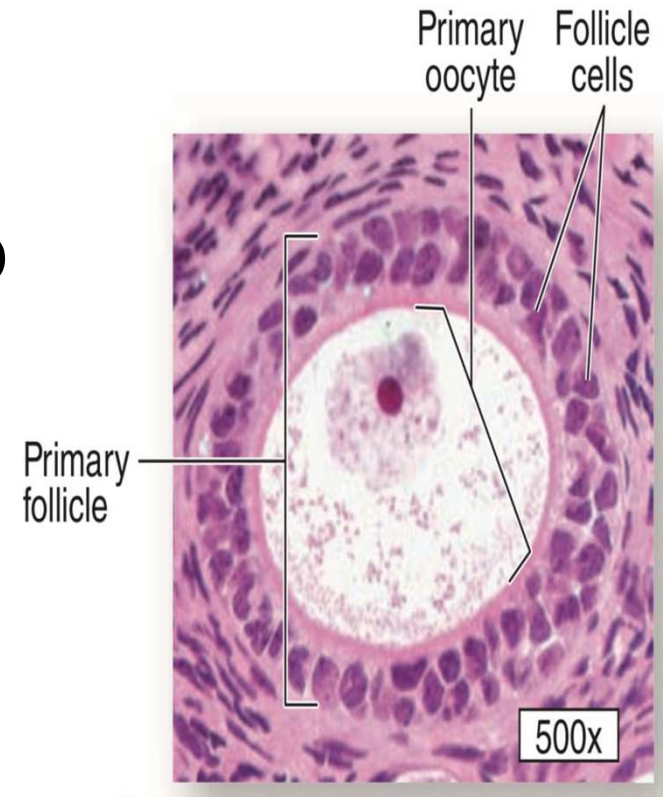
# Stages of follicular development

**1. Primordial follicles:**  
consist of a primary oocyte enveloped by a single layer of flattened follicular cells.



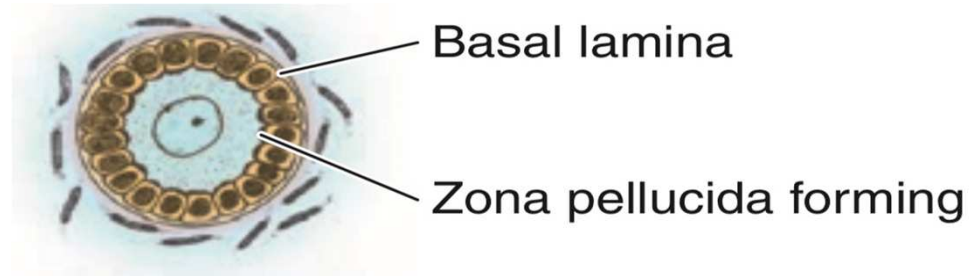
## 2. Primary follicles:

the follicular cells undergo mitosis and form simple cuboidal epithelium around the growing oocyte, this stage proceed in two steps:



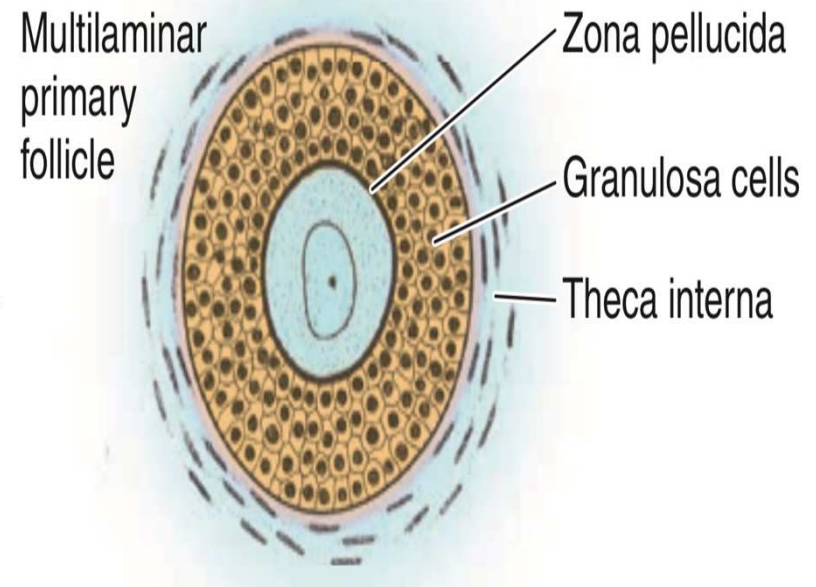
## A. Unilaminar primary follicle:

• Lined by single layer of simple cuboidal cells

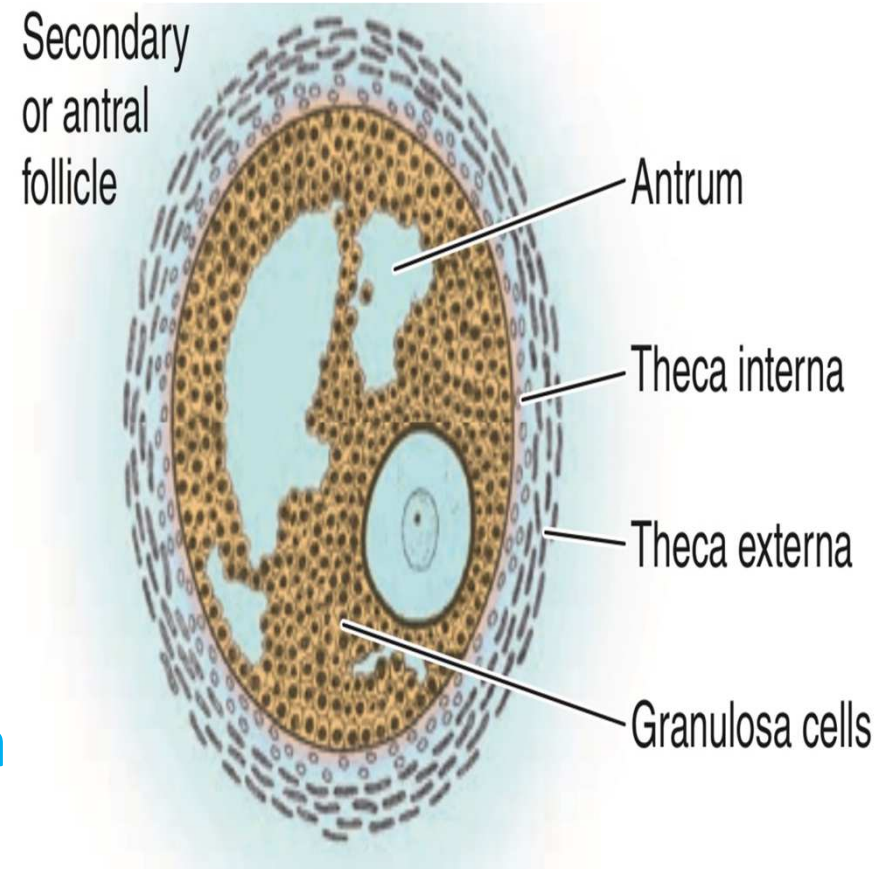


## B. multilaminar primary follicle:

• Lined by stratified follicular cells( granulosa cells), between the oocyte and the first layer of granulosa cells an extracellular material accumulate as the **zona pellucida**

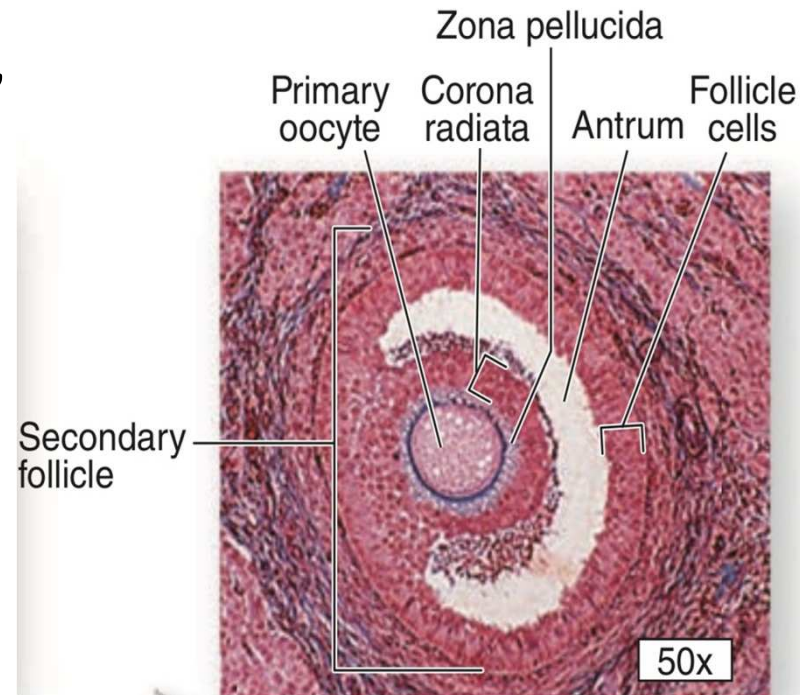


. Stromal cells immediately outside the growing primary follicle differentiate to form **follicular theca** , which further differentiate into two distinct layers :  
**theca externa** and **theca interna**



### 3.Secondary or Antral follicle:

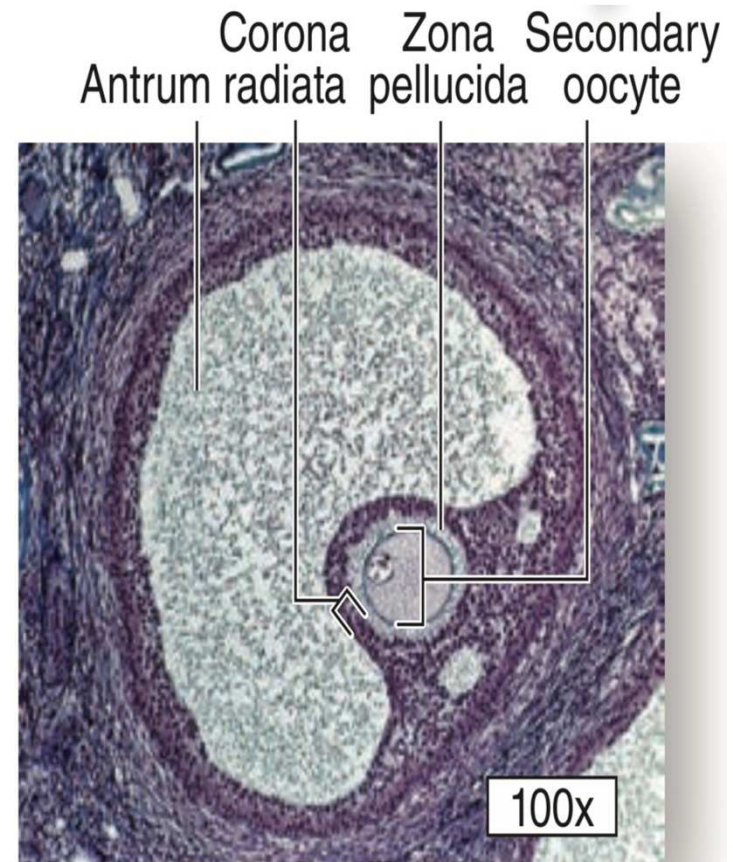
As the primary follicle grow, they move deeper in the cortex , within such follicles small spaces appear between the granulosa layers, they enlarge gradually coalesce to form a large cavity called the **antrum**.



## 4. Mature or Graafian follicle:

.the single large antrum accumulate more fluid and expand to a diameter of 2 cm.

.the granulosa cells immediately surrounding the zona pellucida make up the **corona radiata**.



# Follicular atresia

. Most ovarian follicles undergo a **degenerative** process called atresia, in which the follicular cells and oocyte undergo apoptosis and removed by phagocytic cells.

.During a typical menstrual cycle , one follicle becomes dominant and develop farther than others.

.This **dominant follicle** reaches the most developed stage of follicular growth and undergo ovulation, while the other follicles( primary and secondary) undergo atresia.

# The ovulation

.It is a hormone regulated process by which the oocyte is released from the ovary.

.Normally occurs around day 14 of a typical 28 cycle , usually only one follicle is liberated during each cycle , but sometimes two or more simultaneously may be expelled.

. Just before the ovulation , the oocyte will complete the **first meiotic** division forming the secondary oocyte.

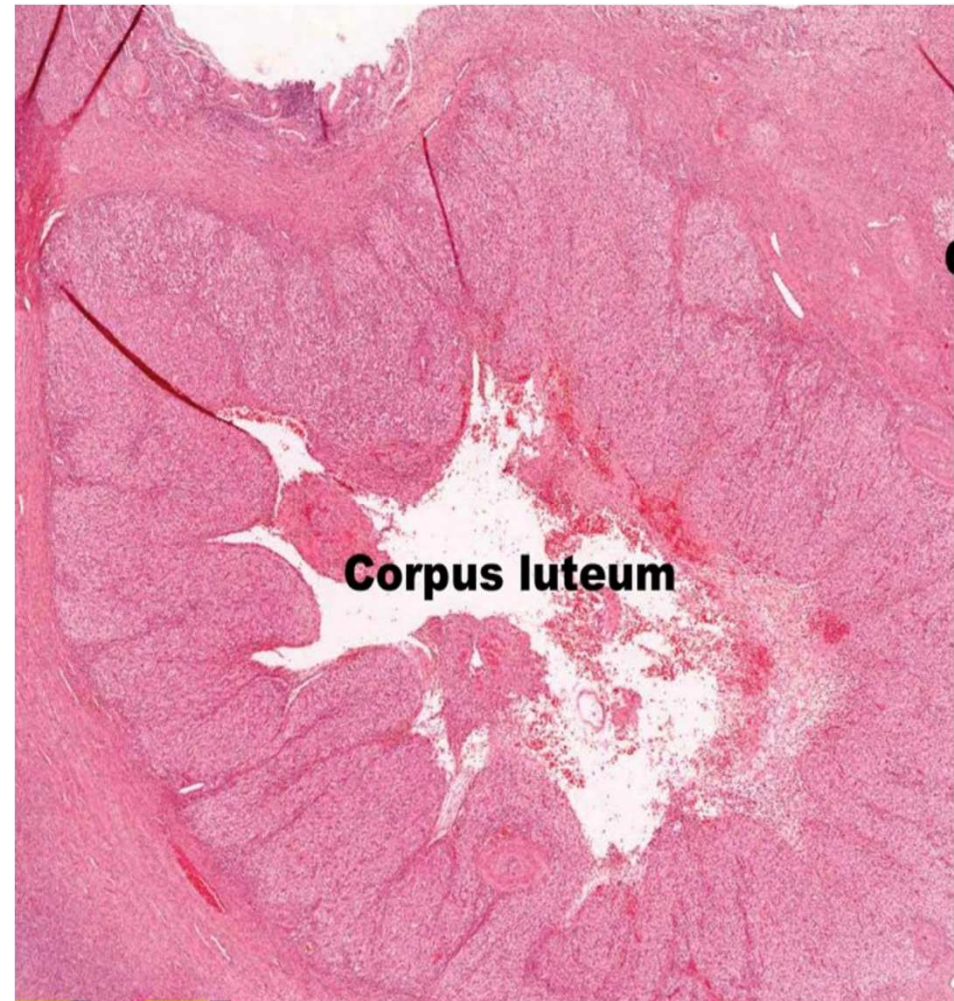
. The follicular development depends on the **FSH** from the pituitary gland, whose secretion is stimulated by gonadotropins releasing hormone (**GnRH**) from the hypothalamus.

- . **Luteinizing hormone (LH)** from the pituitary gland trigger series of events that culminate in ovulation.
- . The increasing pressure within the follicle by the expanding fluid within the follicle causing bulging against tunica albuginea and weakening of the wall leading to rupture of the ovarian surface at the **stigma**, releasing the oocyte surrounded by zona pellucida with the follicular fluid.
- . If not fertilized within **24 hours** the released secondary oocyte begin to degenerate.

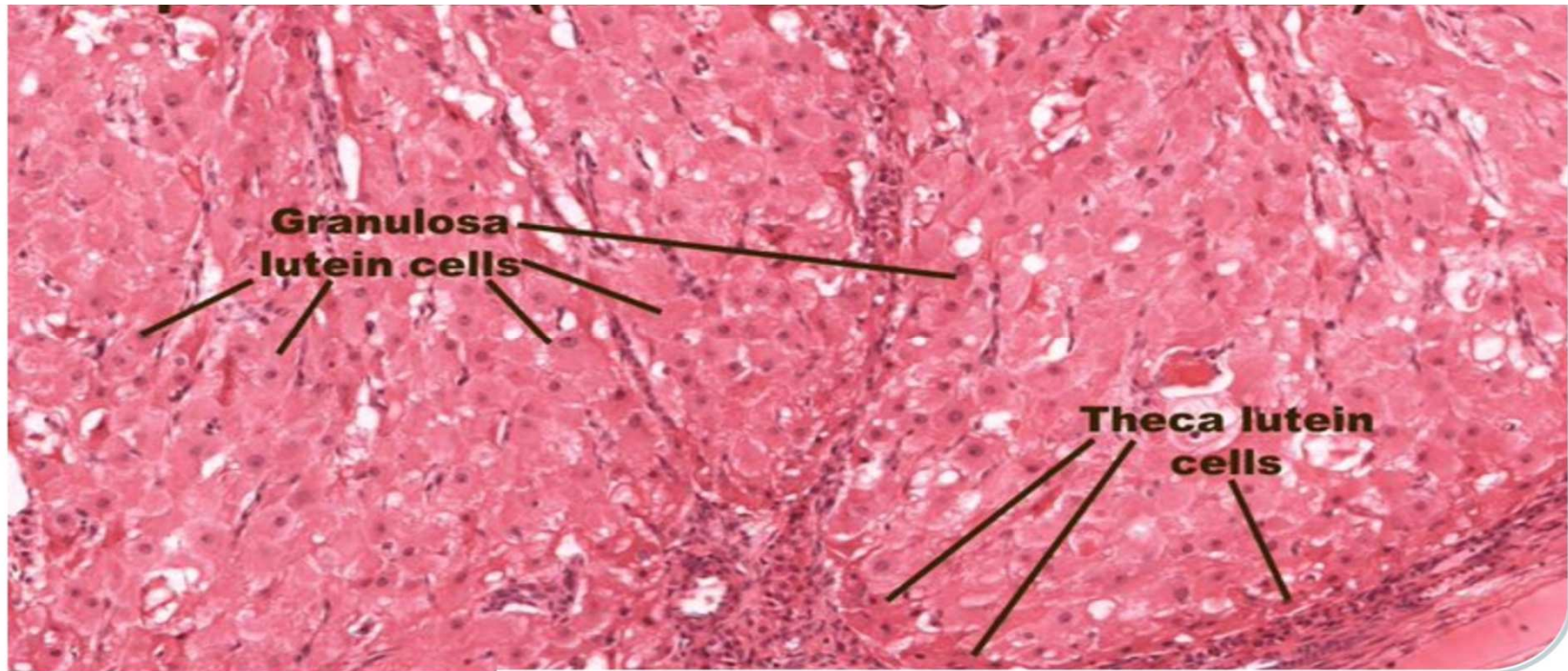
# Corpus luteum(CL) of the ovarian cycle

.The cells of the ovulated follicle redifferentiate under the influence of **LH** forming the CL (**yellowish body**) by collapse and folding of the granulosa and thecal cells with blood accumulation as a **clot** in the former antrum.

. Both of granulosa and theca cells change histologically and functionally under the effect of LH producing more extensive progesterone in addition to the estrogen.



.Granulosa cells increase greatly in size forming 80% of the CL known now as **granulosa lutein cells**, the former theca cells form the rest of CL as **theca lutein cells** which are darker and smaller than granulosa lutein cells and typically aggregated in the wall of the CL.



.The **Fate** of CL depend on whether pregnancy occurs, the ovulatory LH cause the CL to secrete progesterone for 10-12 days, without further LH release and in the absence of pregnancy the CL undergo regression, a consequence of the decreased progesterone is the menstruation.

## Corpus albicans (white body)

It is an inactive mass  
of dense connective  
tissue scar formed by  
regression of CL



# Corpus luteum of pregnancy

.When pregnancy occurs , the trophoblast cells of the implanted embryo produce human chorionic gonadotropins (**HCG**) hormone which maintains and promotes further growth of CL, stimulating secretion of **progesterone** to maintain the uterine mucosa.

.CL in pregnancy becomes very large and is maintained by HCG for **4-5 months**, by that time placenta produces progesterone at levels adequate to maintain the uterine mucosa ,it then degenerate and replaced by large corpus albicans.

## 2.The uterine tubes:

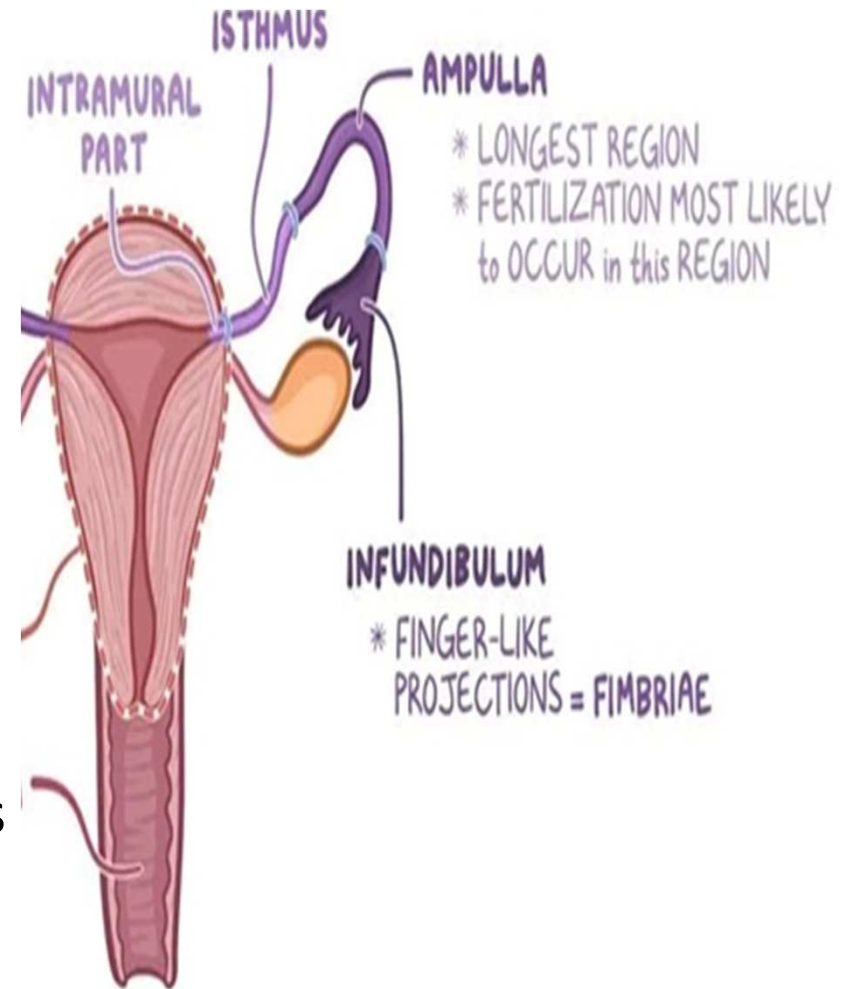
. They are paired and each is about 10-12 cm in length, they open into the peritoneal cavity near the ovary , Each consist of :

**1. Infundibulum:** a funnel – shaped opening with finger like projections ( Fimbria).

**2. Ampulla:** the longest and expanded region where fertilization occurs.

**3. Isthmus:** narrow portion near the uterus.

**4. Uterine or the intramural part :** passes through the wall of the uterus and opens into the interior of this organ.



The wall of the oviducts consist of the following layers:

**1. The mucosa:** numerous branching and longitudinal folds lined by **simple columnar** epithelium of 2 types:

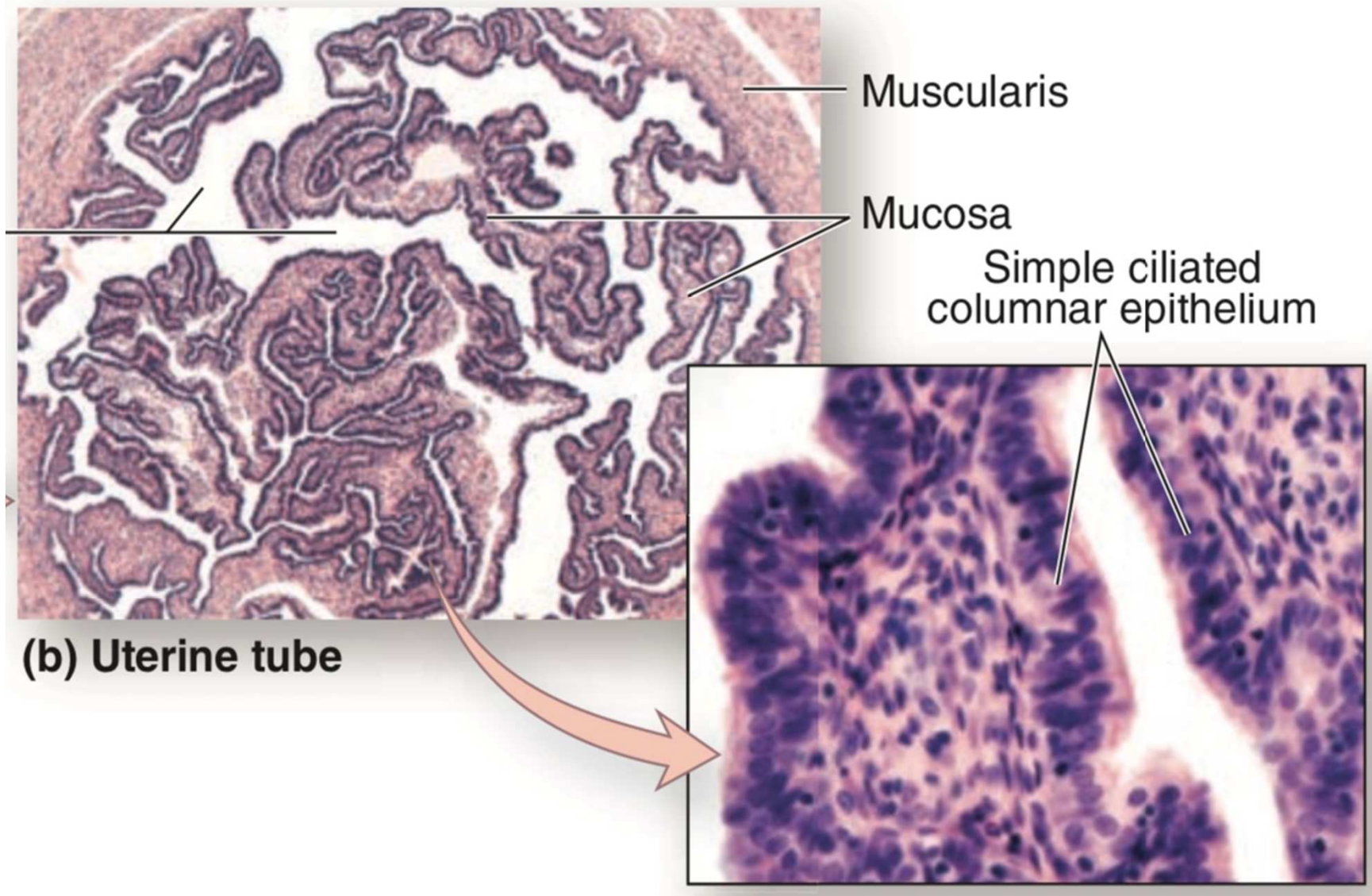
- **ciliated cells:** sweep fluid toward the uterus.
- **non ciliated ( secretary Peg cells):** darker staining cells that secret nutritive substances.

**2. Lamina propria :** loose connective tissue

**3. Muscularis :** inner circular and outer longitudinal layers of smooth muscles.

**4. Serosa.**

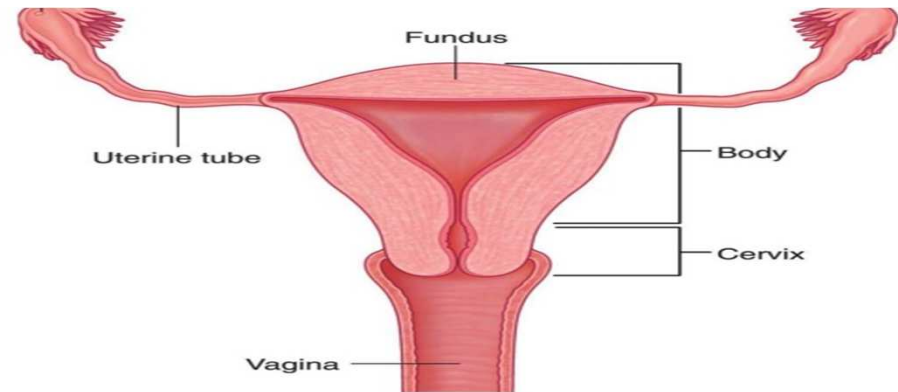
# Uterine tube



# 3.The uterus

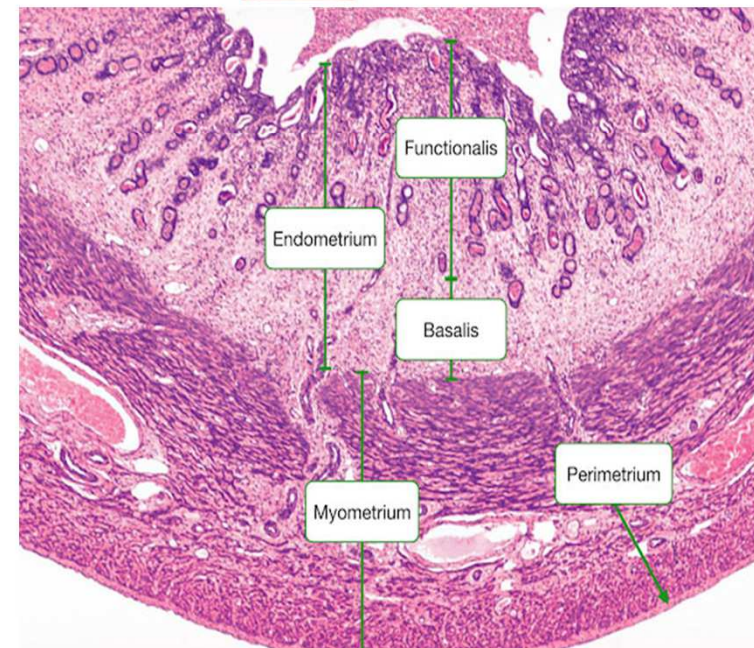
The uterus is a pear shaped organ with thick muscular wall, it has three parts:

1. The fundus
- 2.The body
- 3.The cervix.



.The uterine wall has three layers:

- 1.The **endometrium**(mucosa)
- 2.The **myometrium**: thick highly vascular smooth muscle layer
- 3.The **perimetrium**: outer connective tissue layer

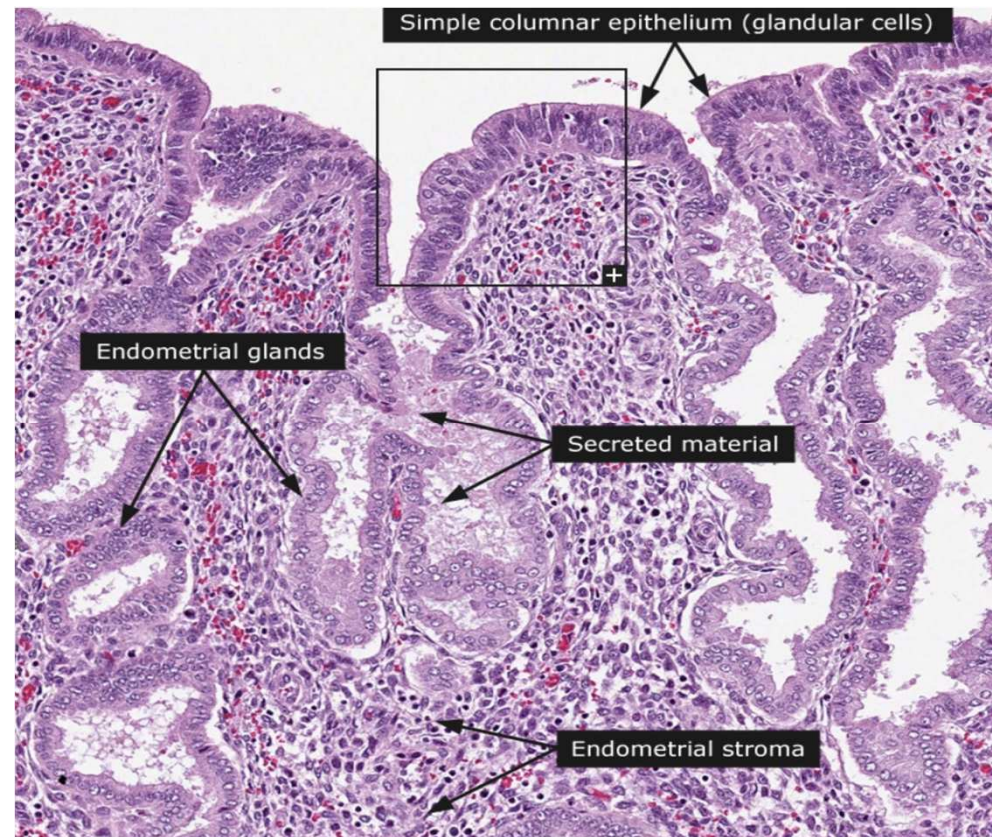


# The endometrium

It is the mucosa of the uterus, it consists of:

A: **Epithelium**: simple columnar epithelium that has both ciliated and secretory cells.

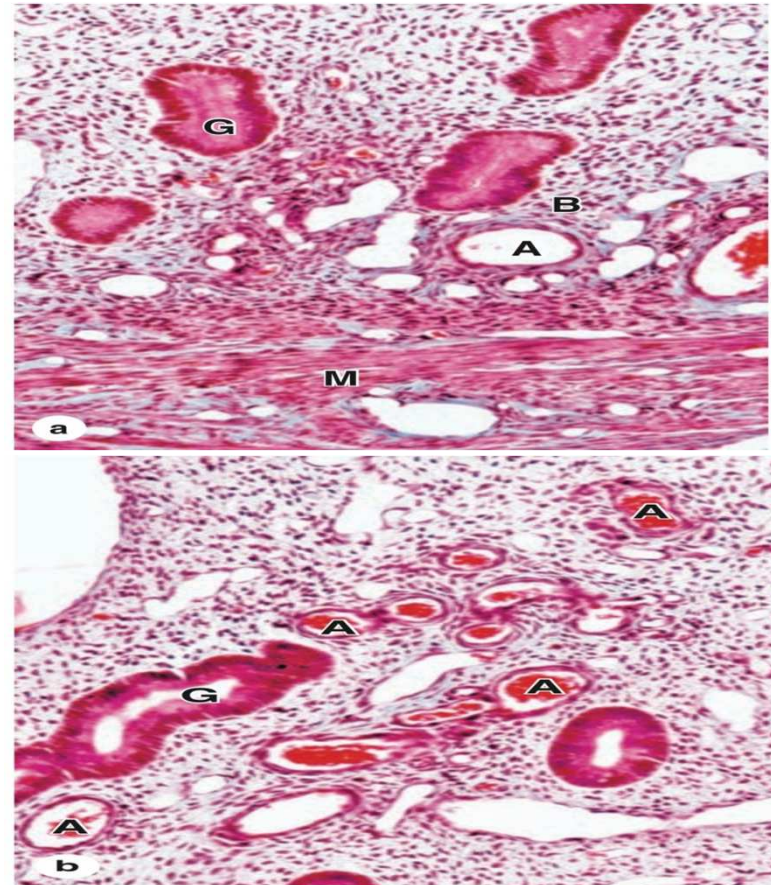
B. **Lamina propria** (uterine **stroma**): contains type III collagen fibers with abundant fibroblasts and ground substance. The entire thickness of the endometrium is penetrated by numerous tubular **uterine glands**.



.The endometrium has 2 concentric zones:

A. **Basal** layer : adjacent to myometrium, has more cellular stroma and contains the end of the uterine glands.

B. **Functional** layer: superficial layer that include most of the length of the uterine glands as well as the surface epithelium.

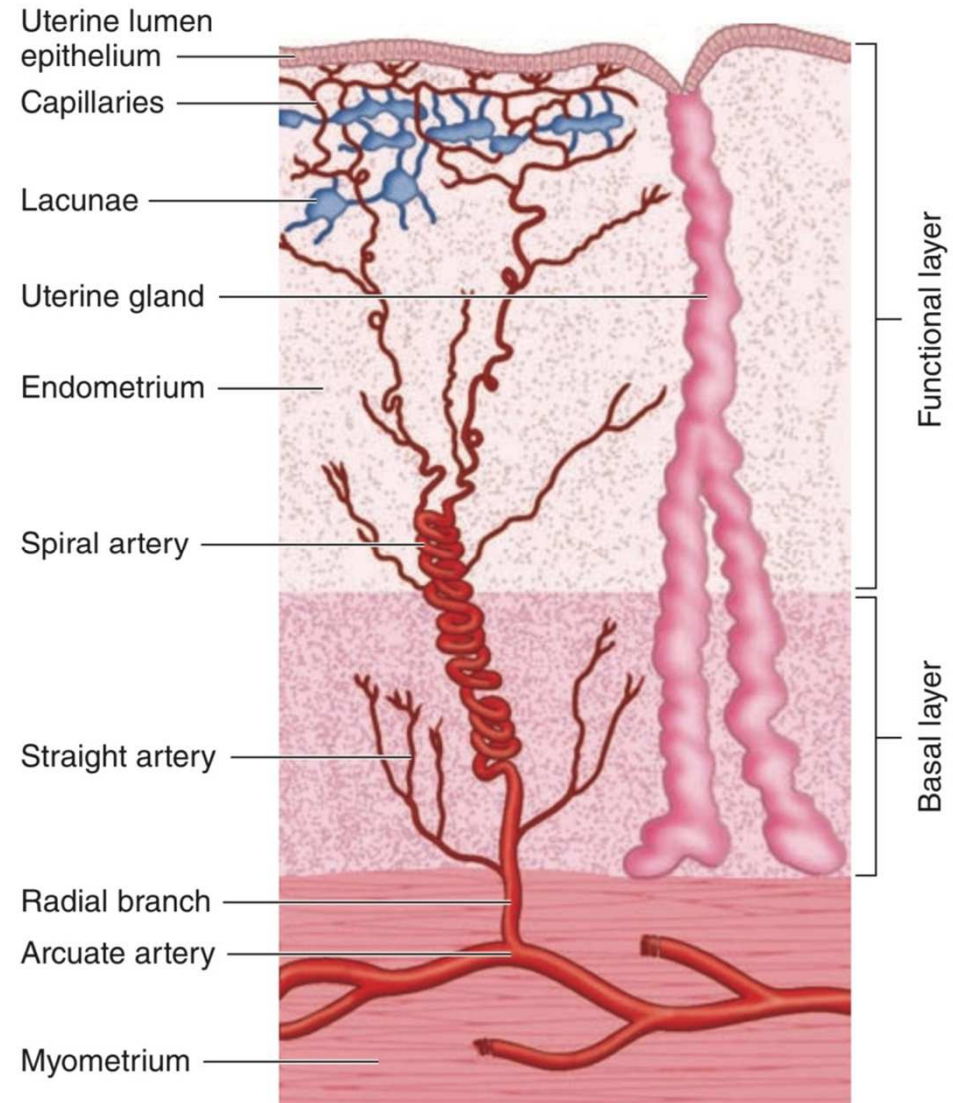


. The functional layer undergo profound changes during the menstrual cycle , while the basal remain relative unchanged.

. **Arcuate** arteries in the middle layers of the myometrium send two sets of smaller branches into the endometrium:

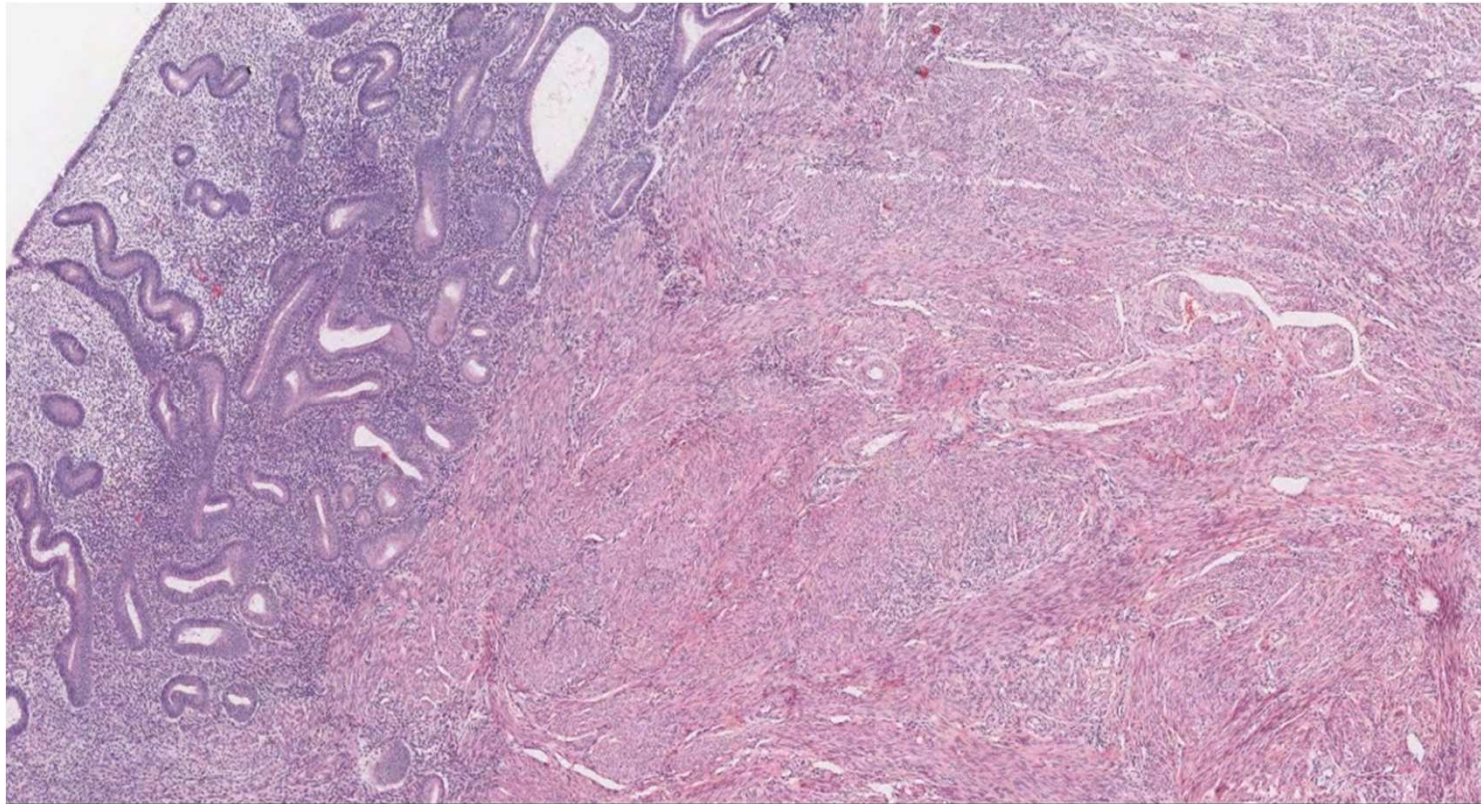
**1. Straight** arteries :  
short arteries that supply the basal layer of the endometrium.

**2. Spiral** arteries :  
long spiral arteries that branch into numerous arterioles and extend farther to supply the functional layer.

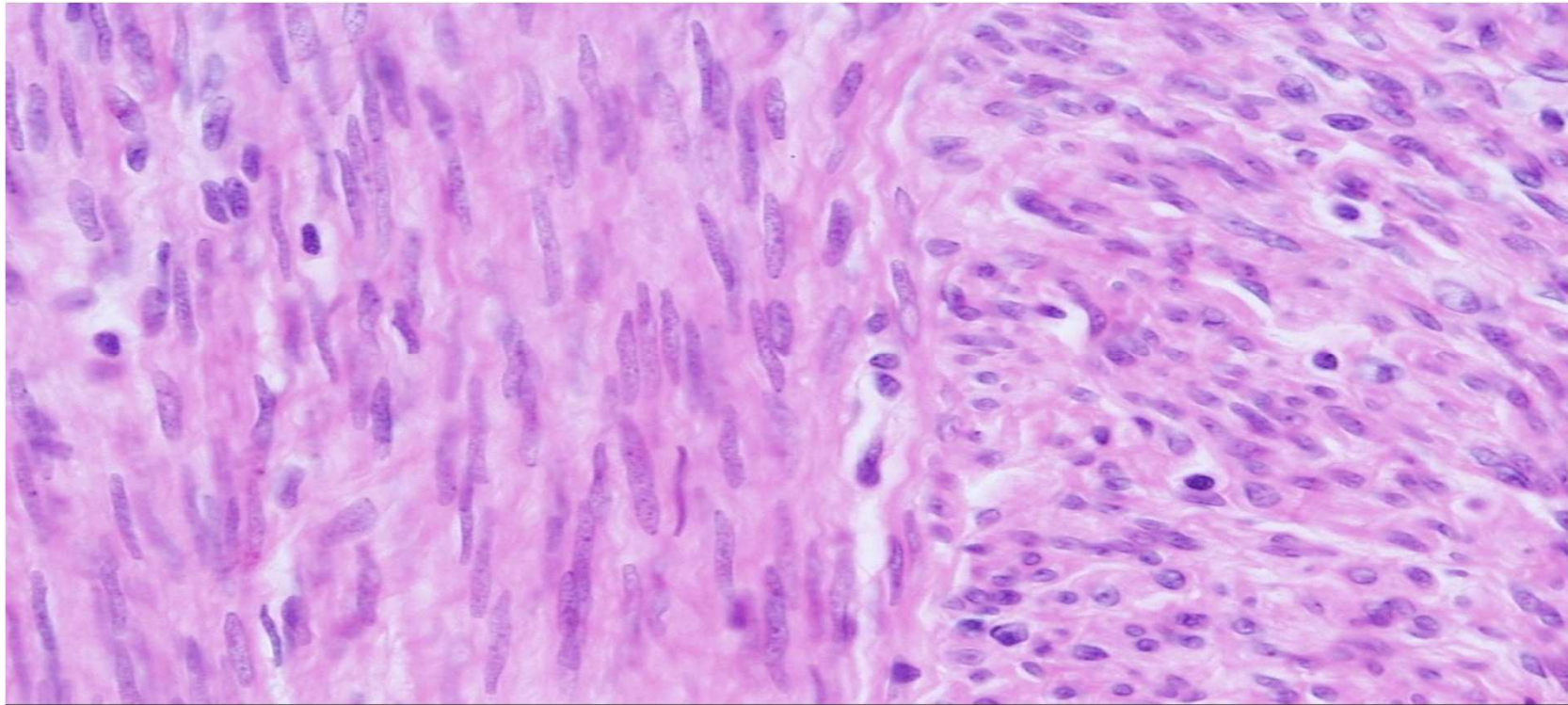


# The myometrium

.The thickest part of the uterus, shows bundles of smooth muscle fibers separated by connective tissue containing venous plexus and lymphatics.



.The smooth muscles form **interwoven** layers, with fibers of both the inner and outer layers arranged parallel to the long axis of the organ.



. **During pregnancy**, the myometrium goes through an extensive growth that involve both **hyperplasia** and **hypertrophy** and an increased collagen production by the muscle cells which strengthen the uterine wall.

. **After pregnancy**, uterine smooth muscles shrink and many undergo **apoptosis** returning to pre-pregnancy size.

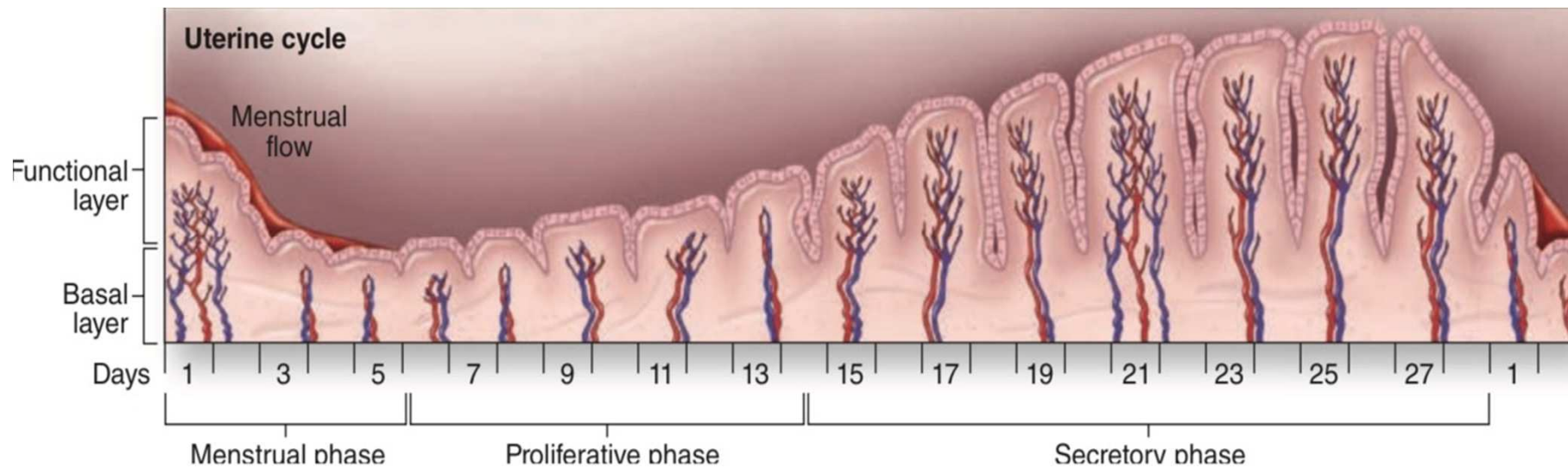
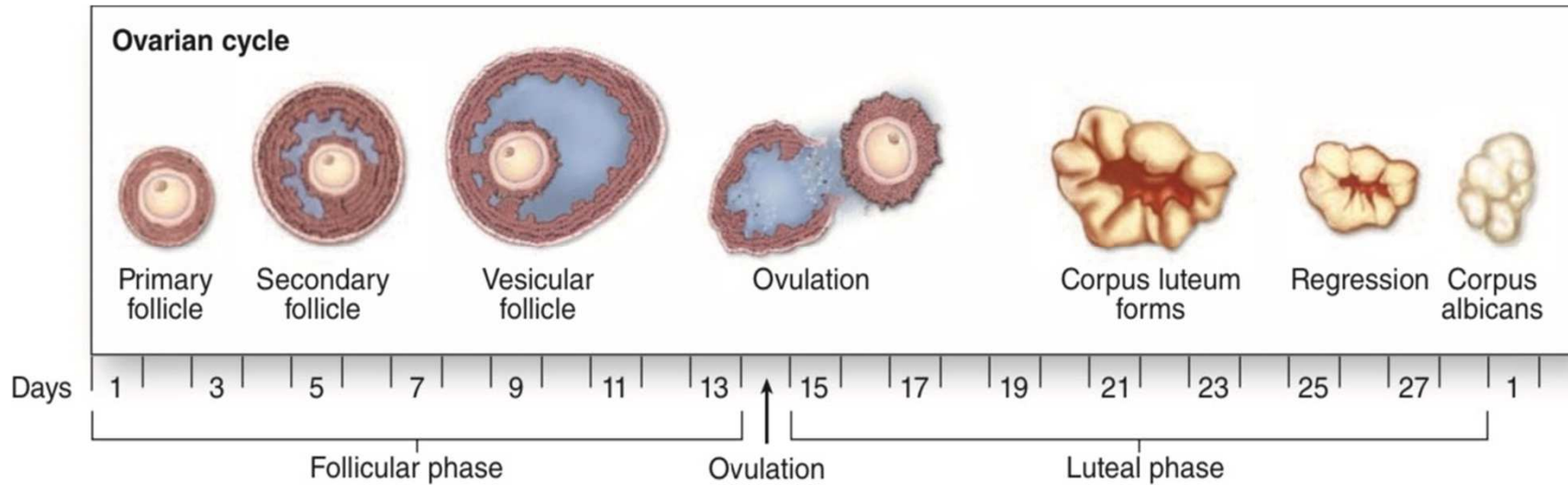
# Menstrual cycle

. From puberty until menopause the pituitary gland produce cyclic changes in ovarian hormones levels which in turn cause the endometrium to undergo cyclic changes during the menstrual cycle providing a suitable environment for the implantation of the fertilized ovum.

The menstrual cycle involve the following phases:

1. **Menstrual** phase(**1-4** days)
2. **Proliferative** phase(follicular or estrogenic)(**5-14** days)
3. **Secretory** phase(progestational or luteal)(**15-28**)

# Ovarian and uterine cycle

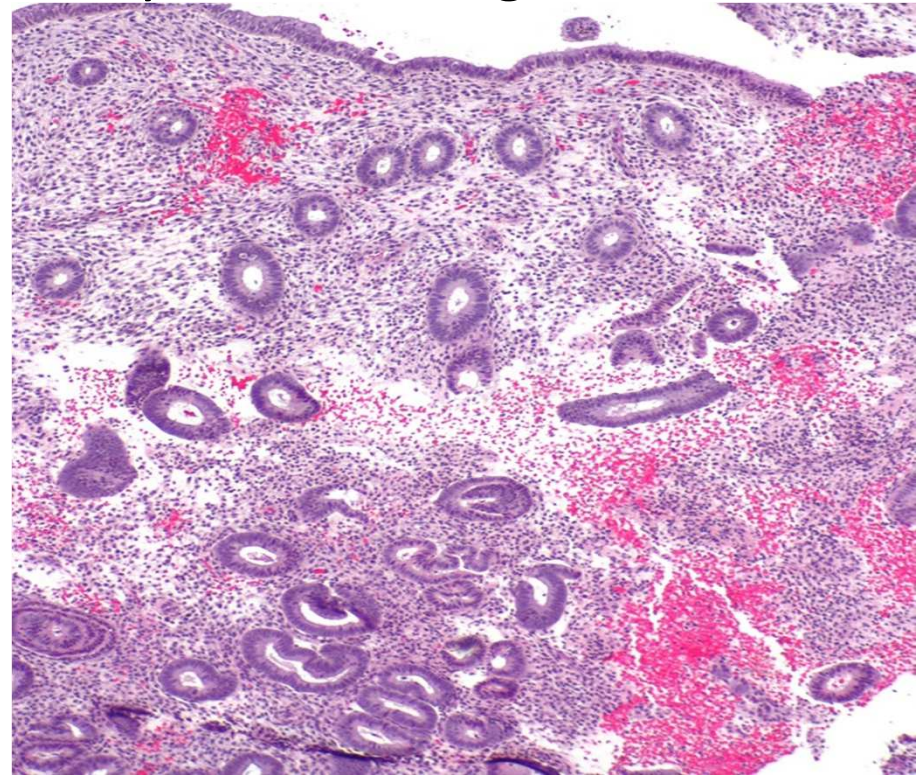


## Proliferative phase:

.After the menstrual phase, the mucosa is relatively thin( 0.5 mm). this phase begin under the influence of **estrogen** which induce regeneration of the functional layer lost during the menstruation:

1. The basal ends of the glands proliferate ,migrate and form new lining epithelium.
2. The uterine glands are relatively straight tubules with narrow empty lumens.
3. Spiral arteries lengthen and form an extensive microvasculature.

. At the end of the proliferative phase , the endometrium is **2-3** mm in thickness.

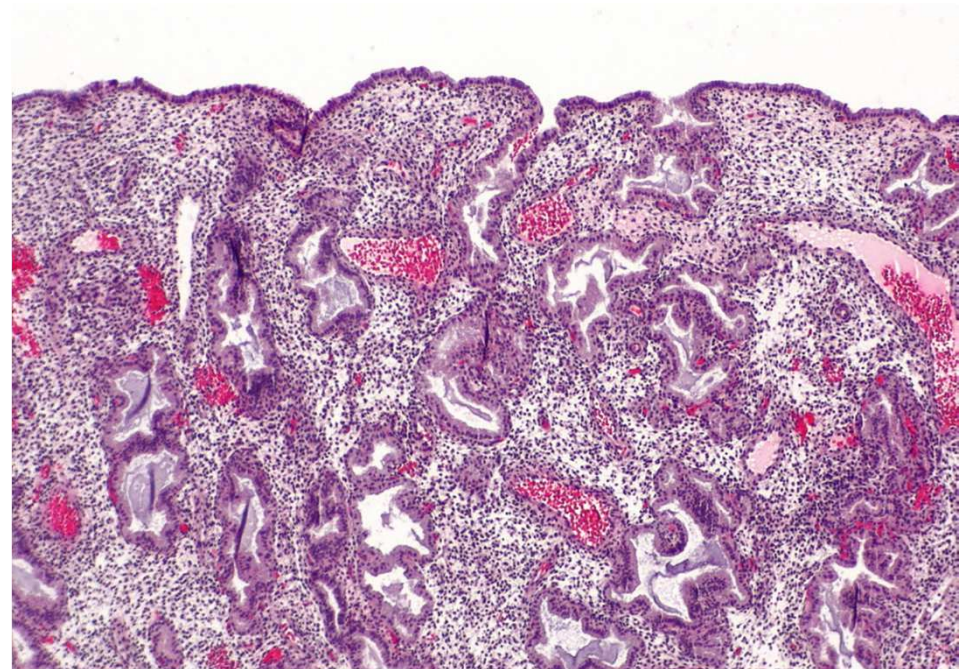


# Secretory phase

.It begins following ovulation as a result of **progesterone** secretion by CL, which induce:

1. Epithelial cells of the uterine gland to secrete and accumulate glycogen, dilatation and coiling of the glandular lumens.

2. Formation of thin walled blood filled lacunae in the superficial microvasculature.

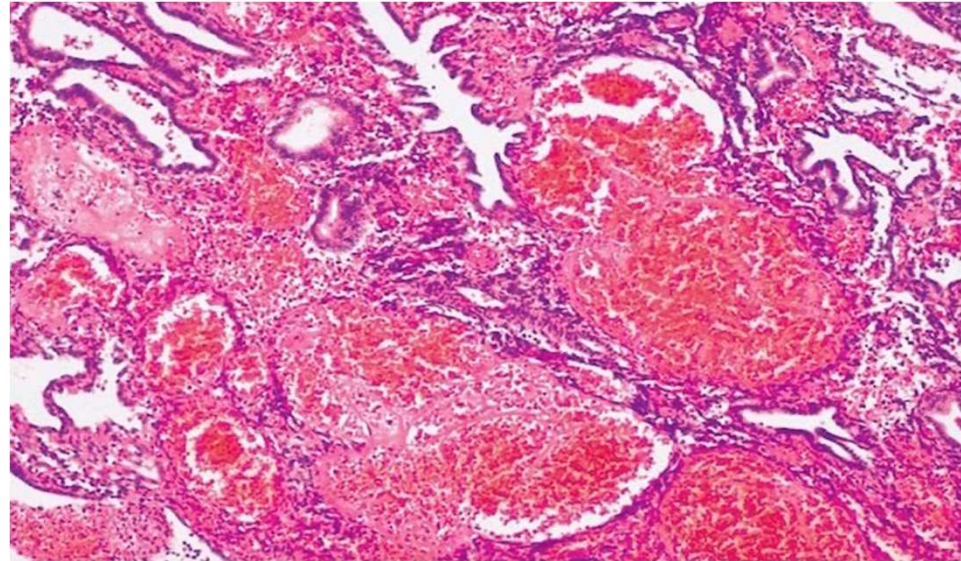


. The endometrium reaches it's maximum thickness during this phase (**5mm**) as a result of the accumulation of secretion and edema of the stroma.

# Menstrual phase

. When fertilization does not occur the CL regresses causing a **drop in the progesterone** level causing the onset of the menstruation. The decrease of progesterone produce:

1. **Spasm** of the muscular wall of spiral arteries interrupting the normal blood flow.
2. Increase the production of **prostaglandins** which induce vasoconstriction.



.The menstrual discharge begin by shedding of major portions of the functional layer of the endometrium and sloughed away as a menstrual flow ( menses) which consists of the degenerated endometrium and mixed with blood from the ruptured microvasculature.