

Histology of The Female Reproductive System

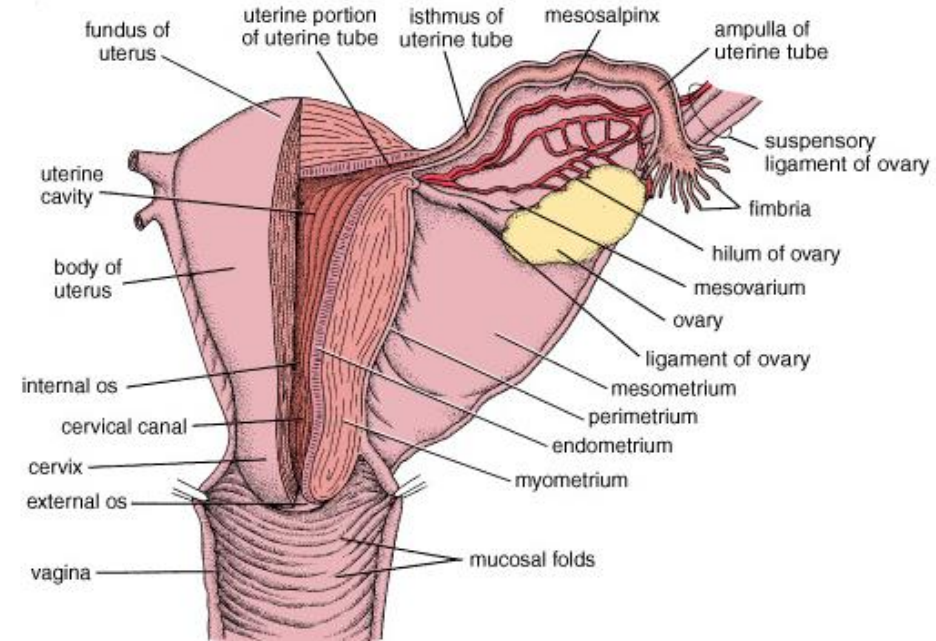
The Female Reproductive System

- **Consists of:**

- **Ovary**
- **Oviduct**
- **Uterus**
- **Vagina**
- **External genitalia**

- **Function:**

- **Production of oocytes**
- **Keep and protect developed oocytes**
- **Production of hormones**
- **Receive and keep the conceptus**

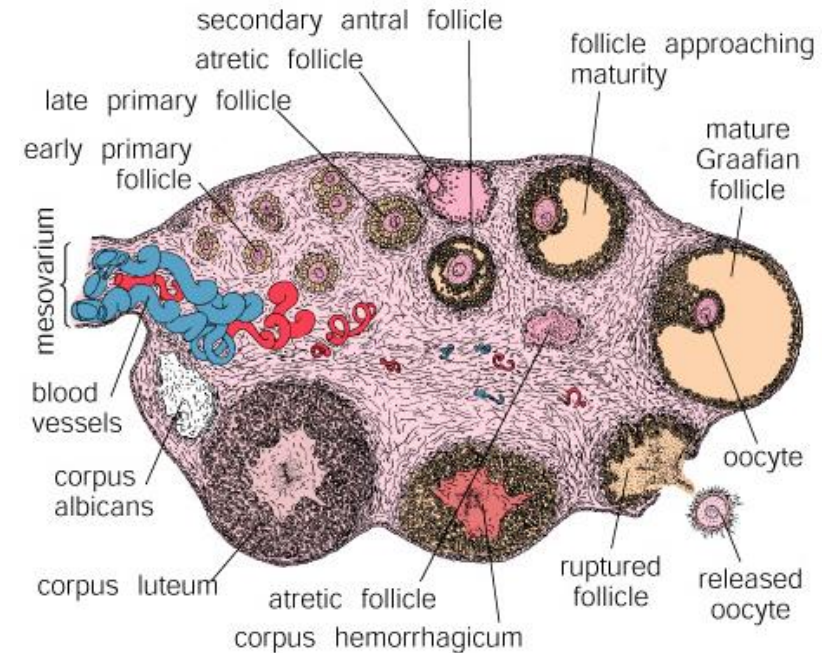


The Ovary

- Almond-shaped body 3X1.5X1 cm
- Covered by **Germinal Epithelium**
- Protected by Tunica Albuginea
- Divided into:

Cortex full of ovarian follicles within the stroma

Medulla is made of loose connective
and is richly vascularized

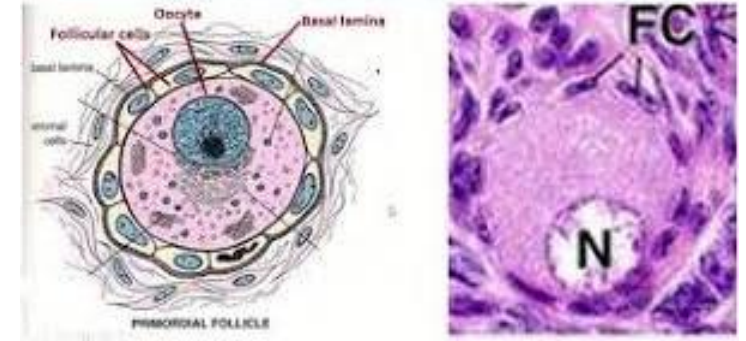


Ovarian Follicles

- Primordial germ cells leave the yolk sac to the ovary in the first month
- They divide and differentiate into oogonia that undergo mitotic division
- In the 3rd month, mitosis stops and the oogonia differentiate into the **primary oocyte**
- **Primary oocytes** begin the **first** meiotic division and stop in **prophase** during **intrauterine** life
- After birth, all primary oocytes are in prophase of the first meiotic division

Ovarian Follicles, Cont.,

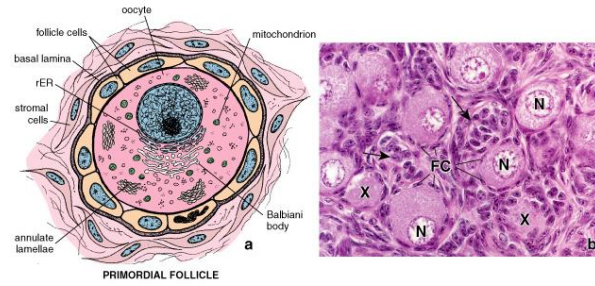
- The primary oocyte surrounds itself with a single layer of flattened follicular cells and becomes a **Primordial follicle**
- Basal lamina surrounds follicular cells and acts as a blood-follicle barrier
- **Follicular atresia**
- At birth, there are about 700,000 follicles and 2/3 of them remain at puberty
- Of the 2/3 (450,000), only 450 are liberated during the female fertile life



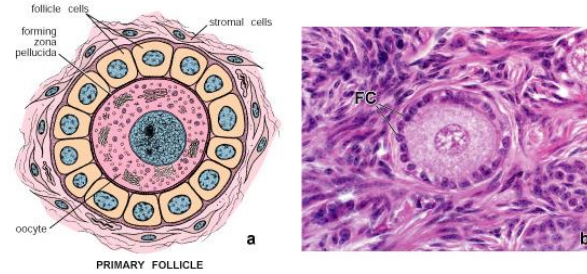
Follicular Growth

- At puberty, FSH induces follicular growth which coincides with the menstrual cycle
- It includes changes in:
 - Growth of oocyte (Cell and Nucleus)
 - Proliferation and changes in **follicular cells**
 - Proliferation and differentiation of **stromal fibroblasts**
- Selection of the primordial follicle destined for growth involves many **hormonal**, differences in **FSH receptors**, **estrogen** synthesis, and **aromatase** activity.
- **Polycystic ovary syndrome**

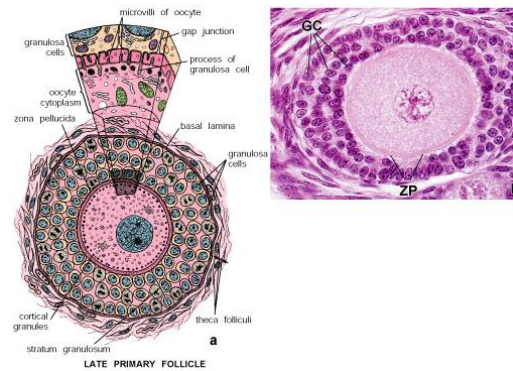
Follicular Growth



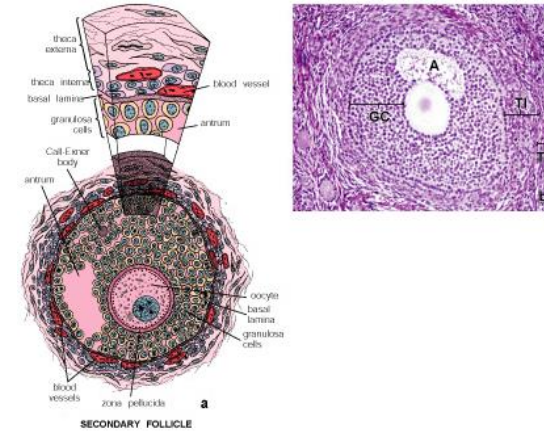
- Primordial follicle



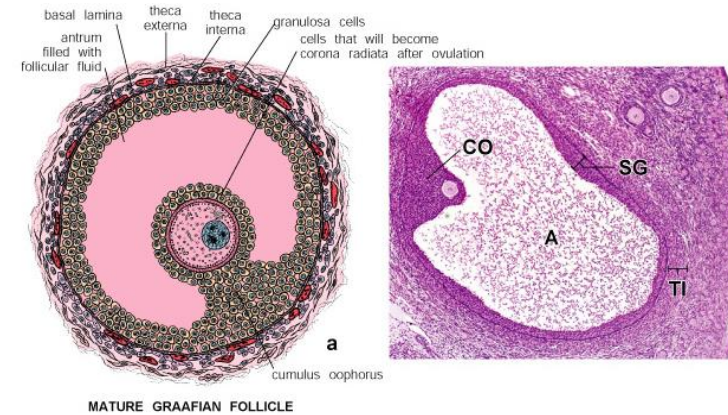
- Primary unilaminar follicle



- Primary multilaminar follicle



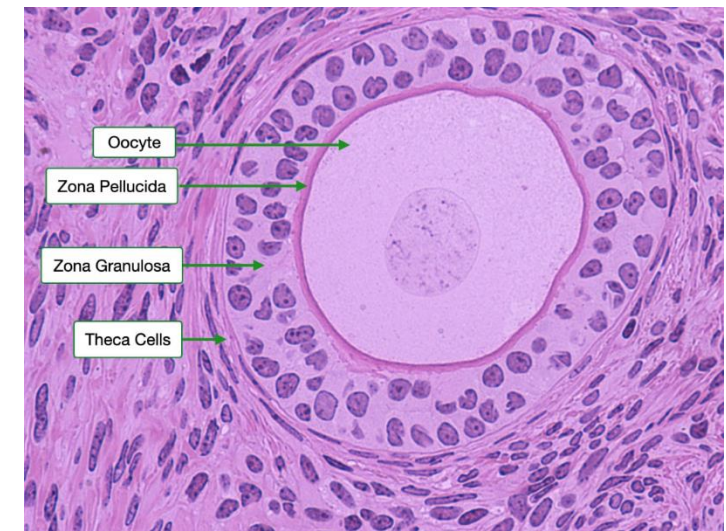
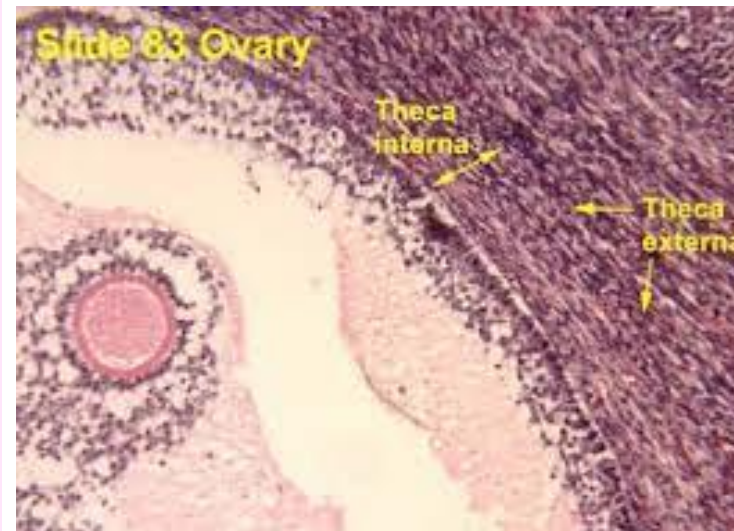
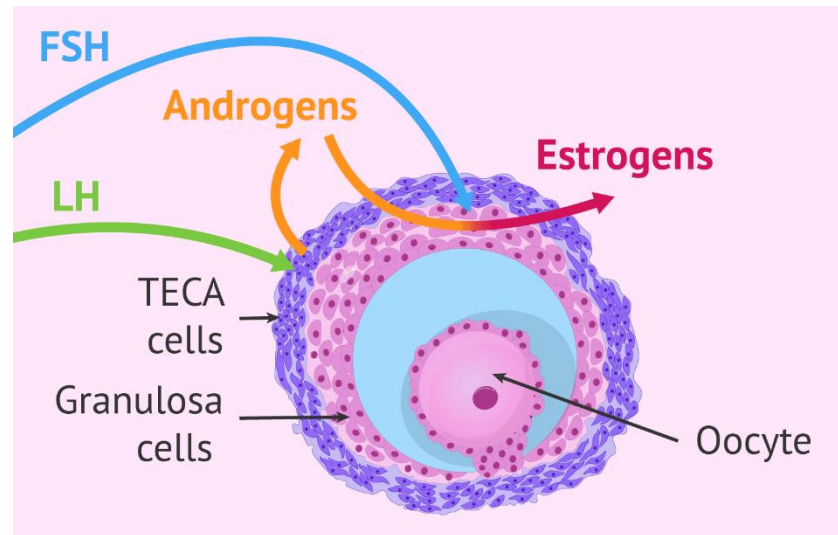
- Secondary, Antral follicle



- Mature follicle

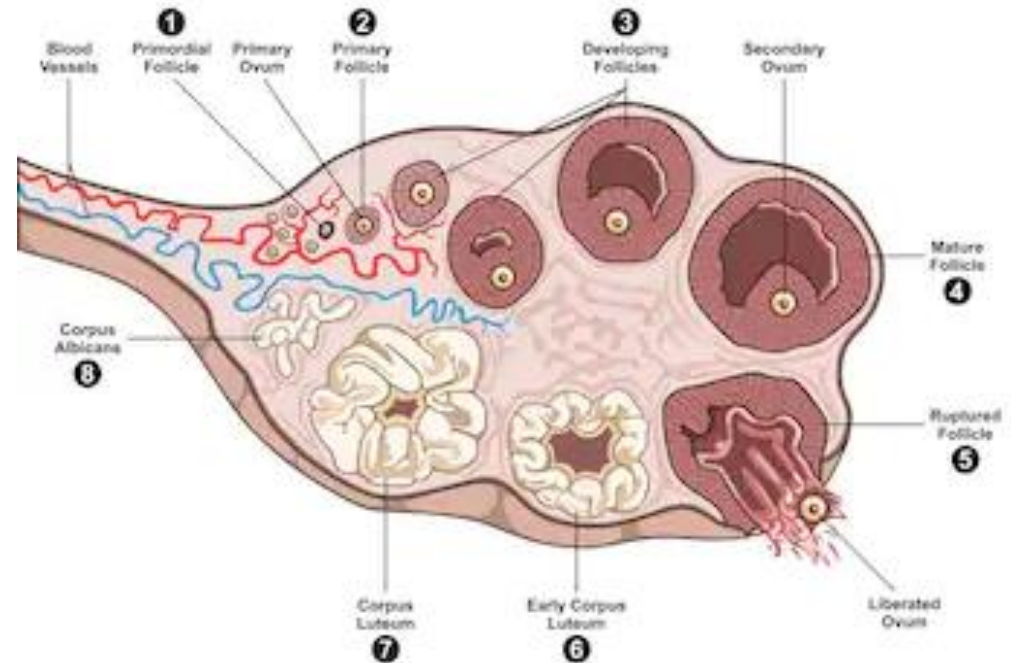
Theca Cells

- Stromal cells surrounding the follicle differentiate into:
 - Outer vascularized cellular layer (**Theca interna**)
 - Inner fibrous layer (**Theca externa**)



Ovulation

- Hours before ovulation, mature follicle bulging against tunica albuginea develops a whitish or translucent ischaemic area called **Stigma**.
- Rupture of the follicle and release of **Oocyte**.
- Expulsion of primary oocyte occurs at the midcycle under the effect of LH surge

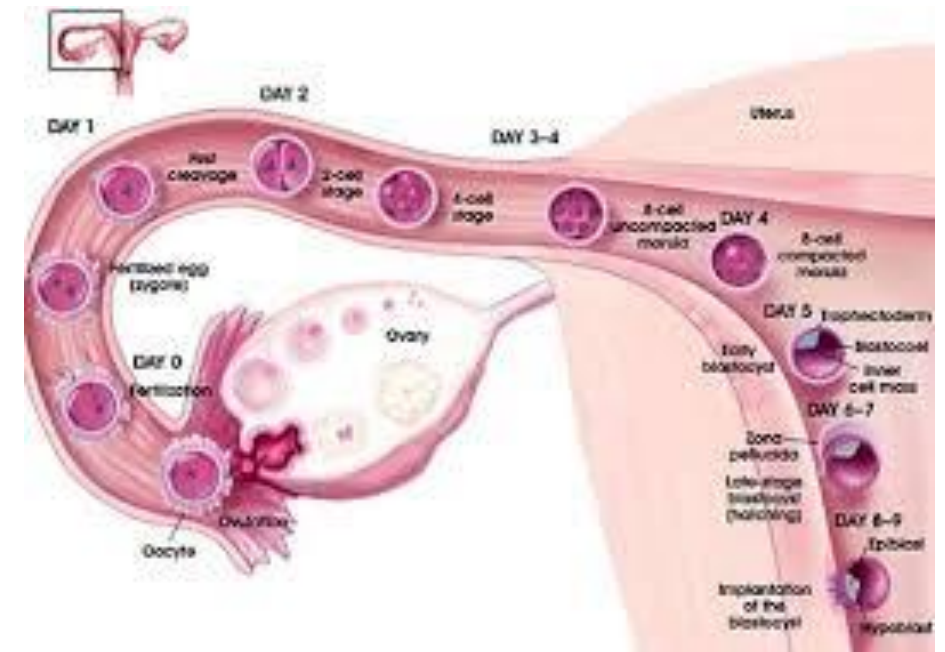


Ovulation

- Following LH surge
 - Granulosa cells secrete large amounts of **follicular fluid**
 - Fluid contains **prostaglandins**, proteoglycans, and **proteases**
- Proteases release the **blood-follicle barrier**
- Cumulus oophorus cells secrete **Hyaluronan** which increases the viscosity of extracellular fluid leading to swell of the follicle and leading to detachment of the oocyte-granulosa cell complex
- Weakness of the wall at the **stigma**
- Spell of **plasmin** from ruptured capillaries degrades collagen in the tunica albuginea
- Contraction of muscle fibers in the theca triggered by **prostaglandin**

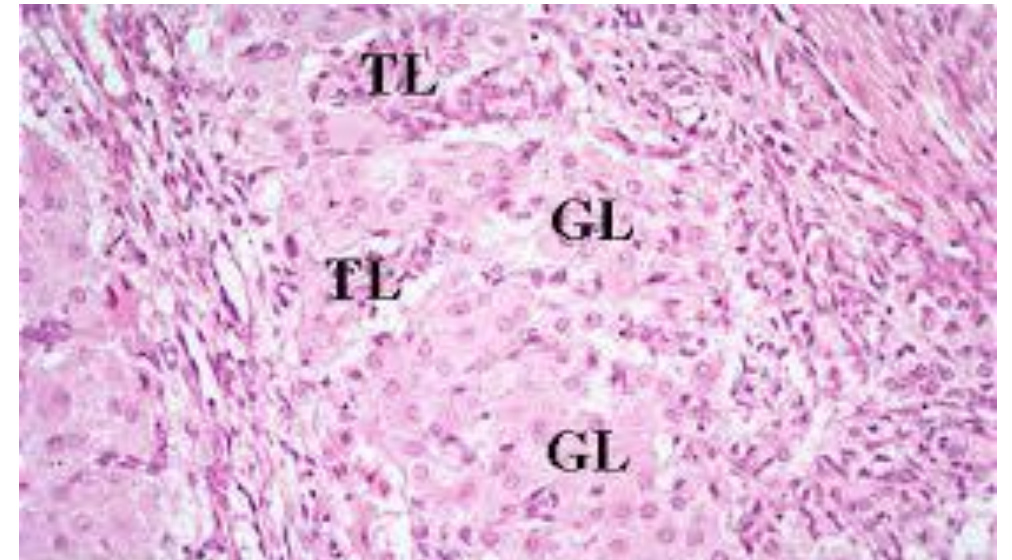
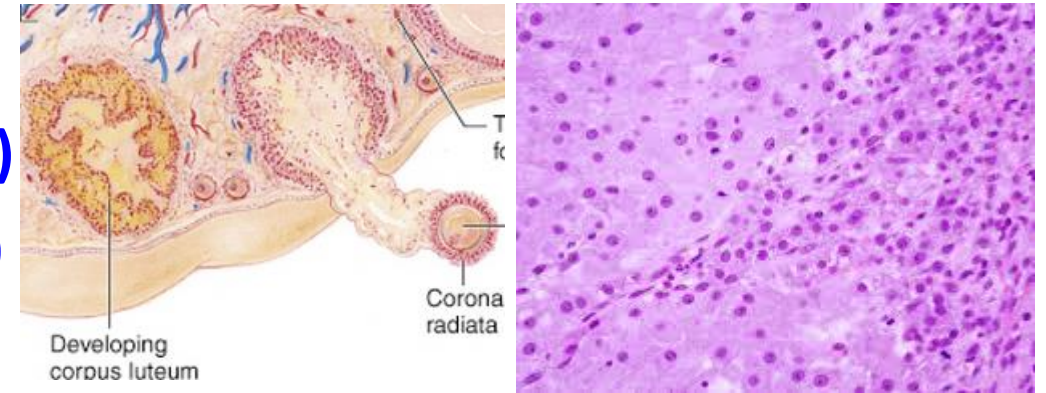
Ovulation

- 1st meiotic division **ends just before ovulation** forming two cells
- They are the **secondary oocyte** and **first polar body**
- After the expulsion, the secondary oocyte starts **2nd meiotic** division and stops at **metaphase**
- Expelled oocyte enters the open end of the oviduct
- Fertilization takes place within 24 hours or death of oocyte ensues
- **Fertilization** triggers the **completion** of the **2nd meiotic** division



Corpus Luteum

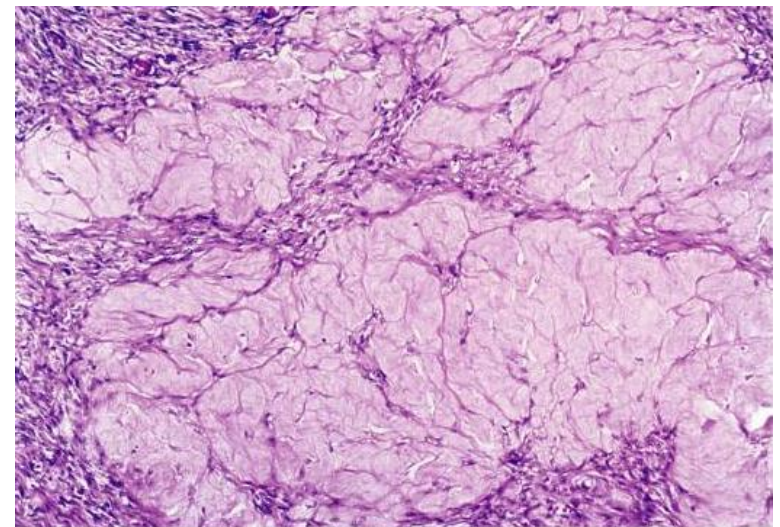
- After ovulation, granulosa cells and theca interna cells reorganize to form an endocrine gland called **corpus luteum**
- Granulosa cells increase in size with steroid secreting characteristics (**Granulosa lutein cells**)
- Theca interna cells become (**Theca lutein cells**)
- Capillaries invade the lumen
- **LH** leads to the formation of corpus luteum and change the set of enzymes to secrete **progesterone** and **androstenedione** → (**estrogen**)



- **Corpus luteum continues to secrete hormones under the effect of LH for 10-12 days**
- It is called the **Corpus luteum of menstruation**

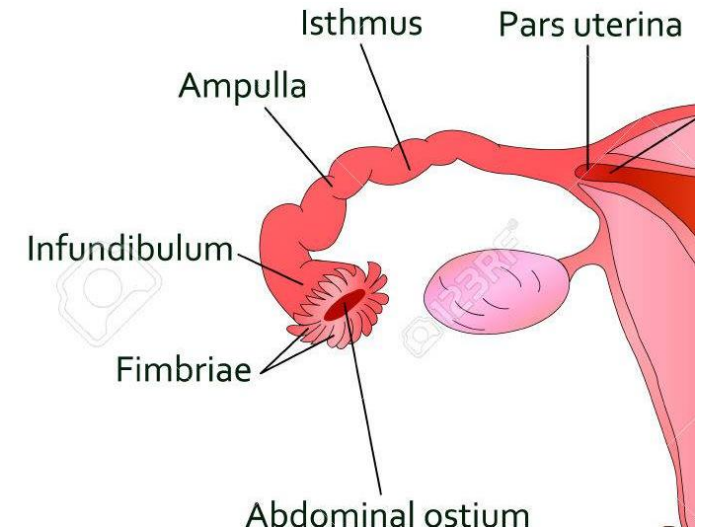
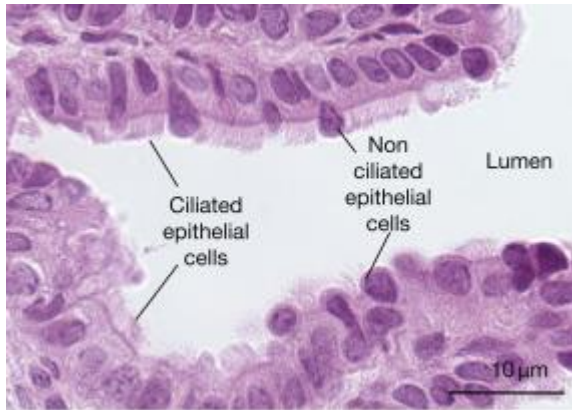
Corpus Albicans

- The large amount of progesterone and estrogen from the corpus luteum leads to decreased FSH
- Corpus luteum of menstruation lasts for 10-12 days
- Without further LH secretion, **progesterone** secretion from the corpus luteum stops, menstruation ensues and **FSH** increases again to start a new cycle of follicular growth
- Remnants of the corpus luteum will be degenerated by apoptosis and phagocytosed by macrophages.
- The area will be invaded by fibroblast leads to the formation of scar tissue called **corpus albicans**
- **Corpus luteum of pregnancy**



Oviduct

- It is divided into **Infundibulum**, **Ampulla**, **Isthmus** and **Intramural**
- The **infundibulum** opens to the peritoneal cavity, while the **intramural** portion opens into the uterine cavity
- Wall consists of:
 - **Mucosa: simple columnar (ciliated) and secretory cells (Peg cells)**
 - **Thick muscularis (Two layers)**
 - **Serosa**



Uterus

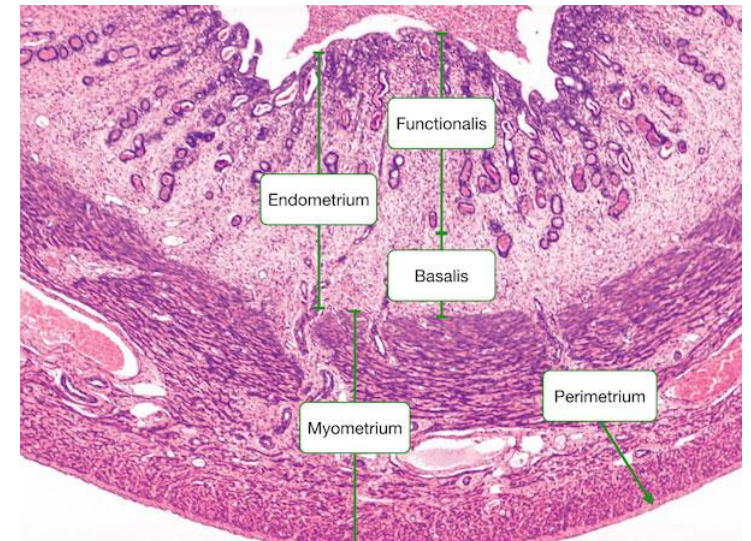
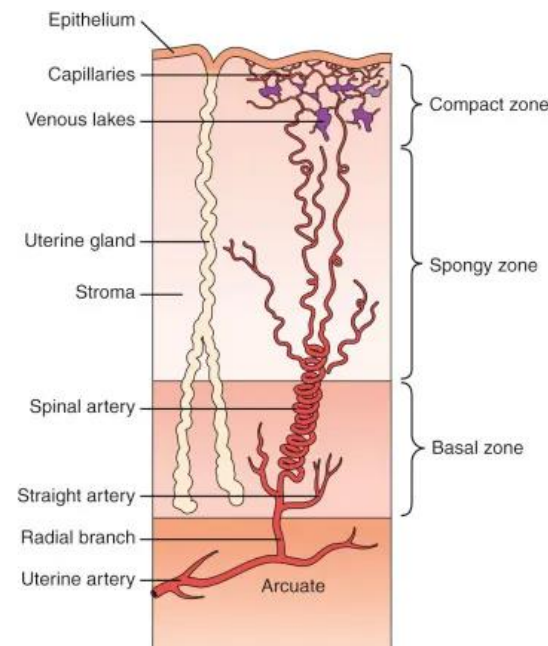
- Wall consists of:
 - Serosa
 - Myometrium: 4 muscle layers
 - Endometrium: epithelium and glands

- Anatomically composed of:

Body

Fundus

Cervix



Menstrual Cycle

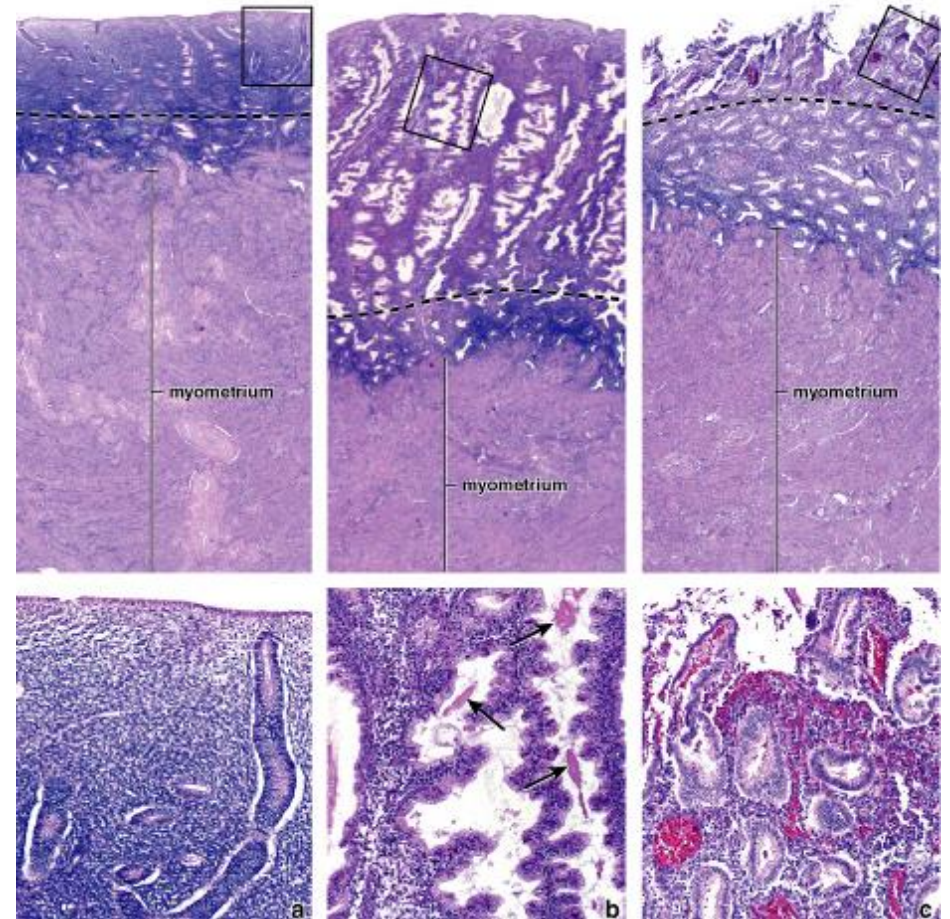
- Menstrual phase
- Proliferative phase (**Follicular, Estrogenic**)
- Secretory phase (**Luteal, Progesteronic**)
- Changes occur in the following:

Thickness

Glands

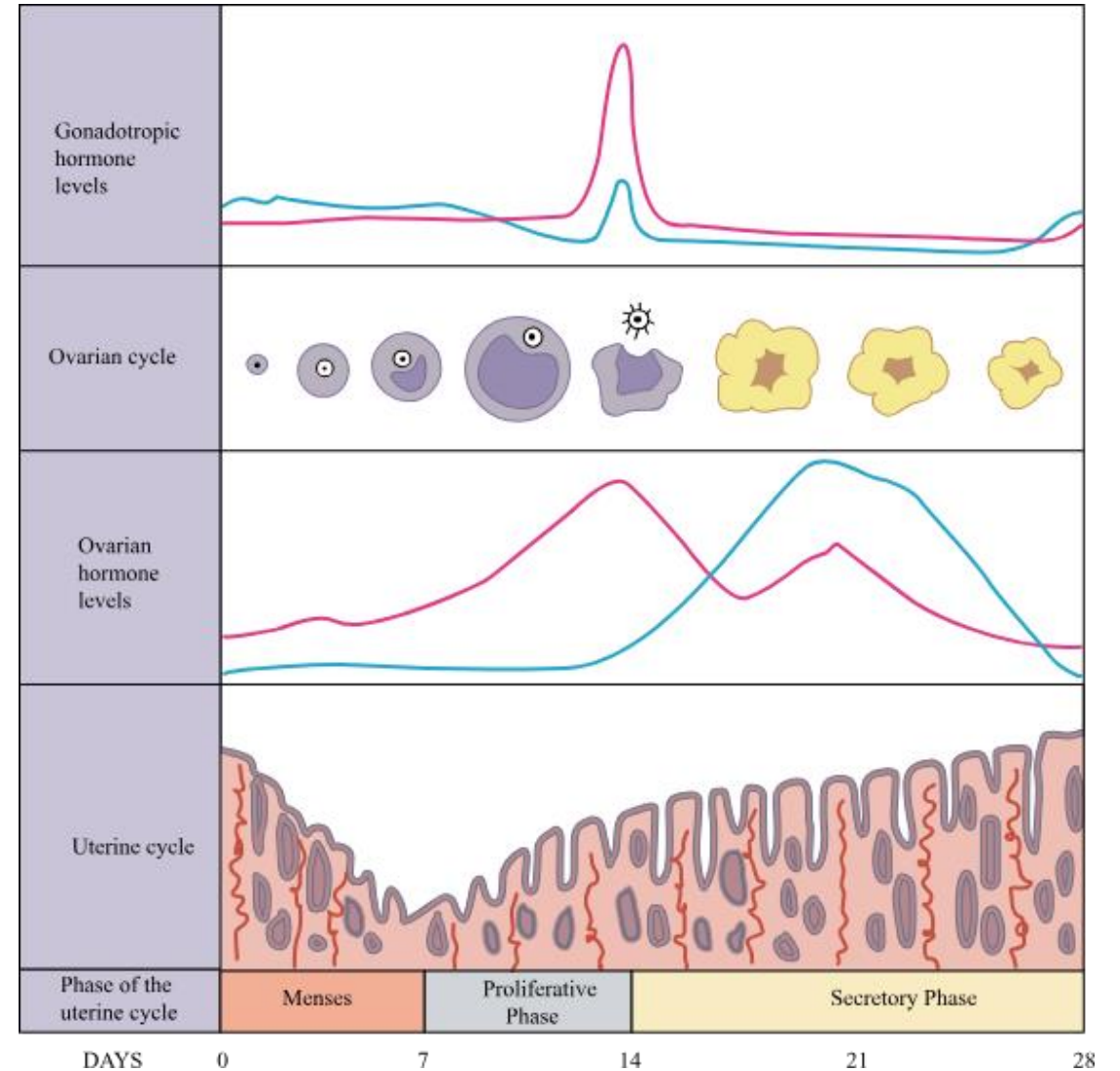
Blood vessels

Ground substance



Ovarian and Menstrual Cycles

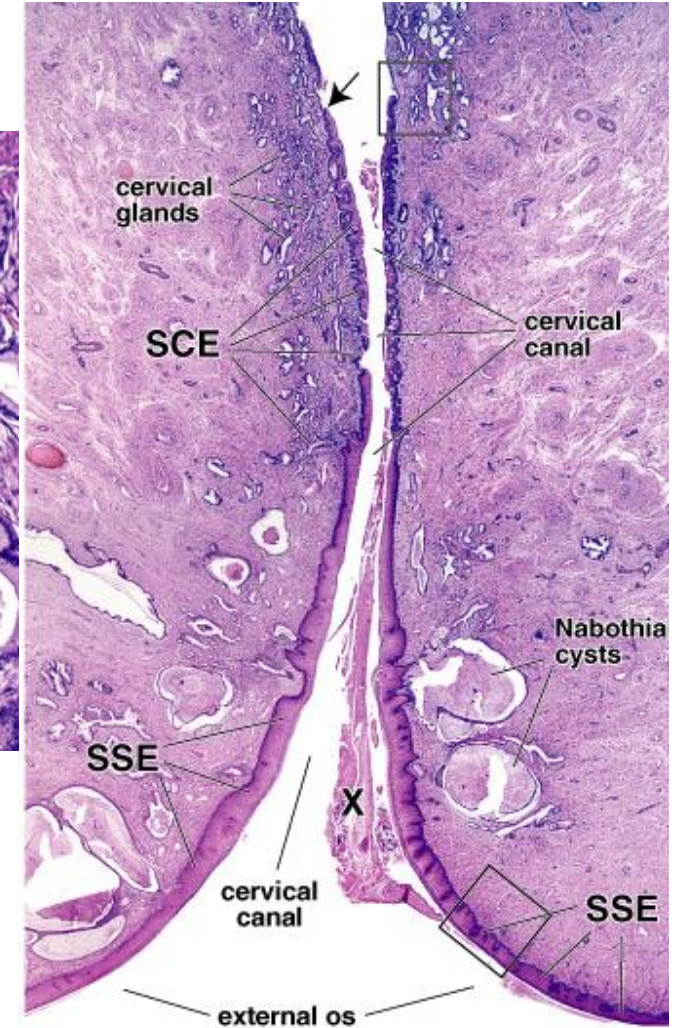
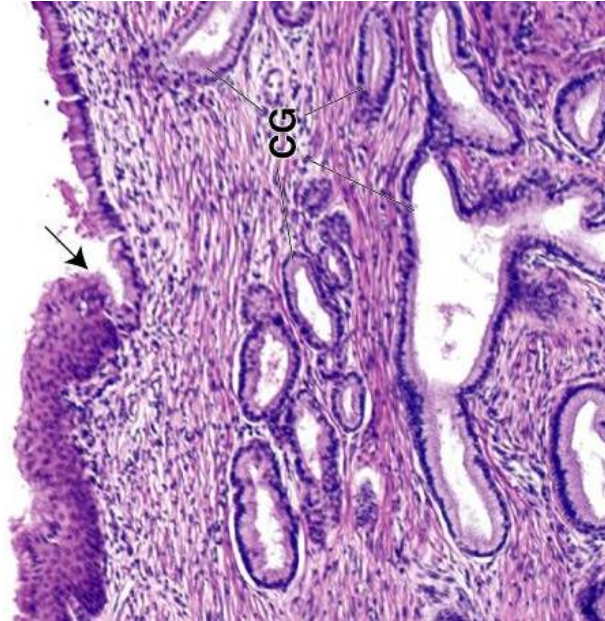
- Association of the ovarian and menstrual cycles' changes and the level of steroid hormones and gonadotropin hormones



Uterine Cervix

It differs from the rest of the uterus.

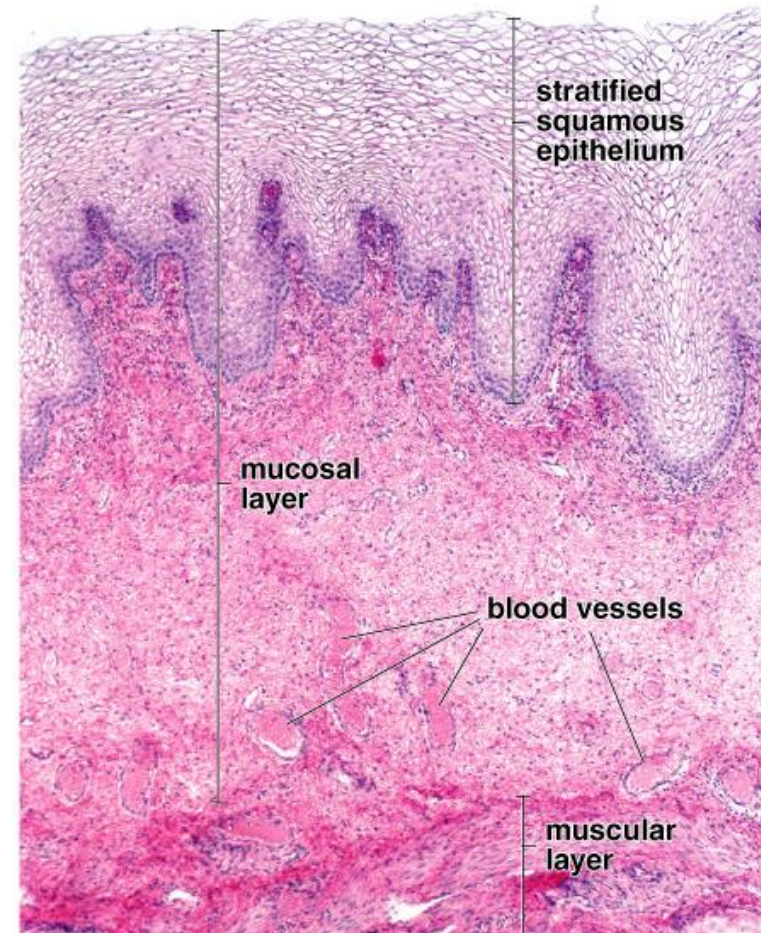
- Lining epithelium
- Glands
- Connective tissue
- Muscle fibers



Vagina

Consists of three layers

- Mucosa
- Muscularis
- Adventitia



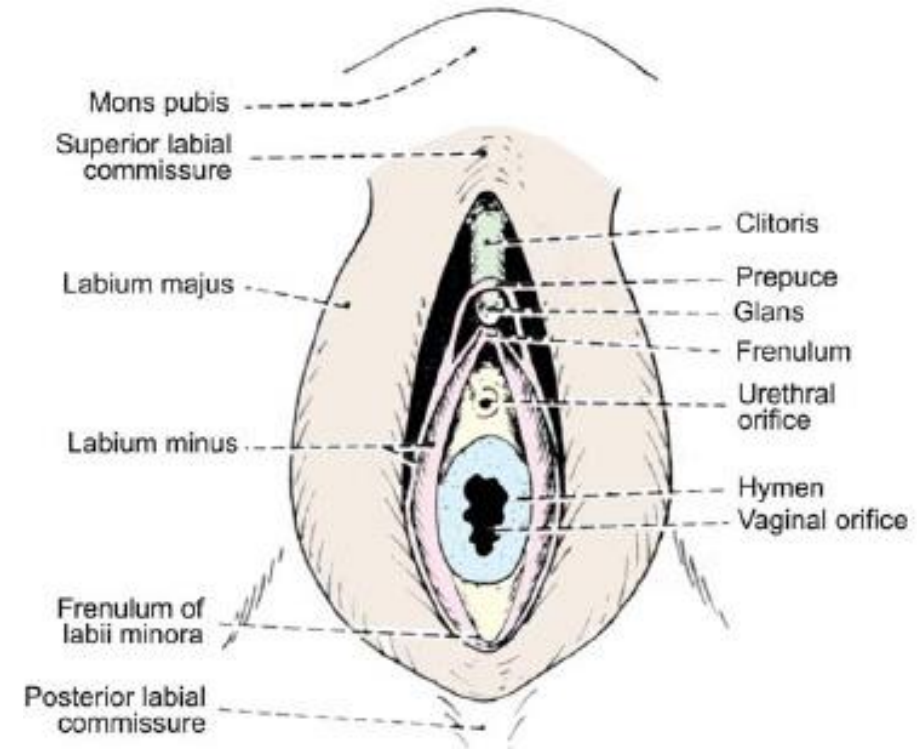
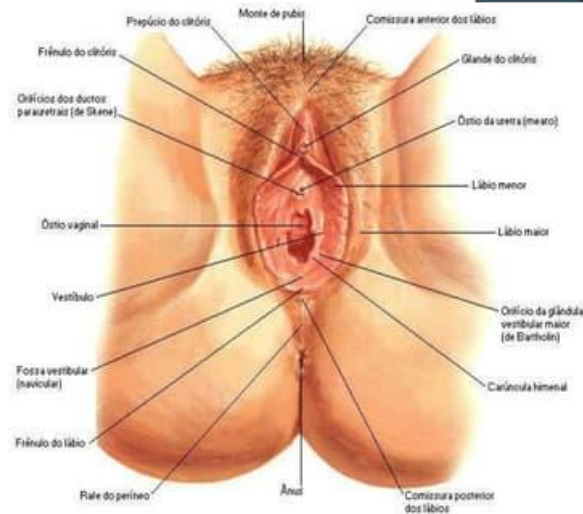
External Genitalia

EXTERNAL GENITALIA (Synonyms: Vulva, Pudendum)

The vulva or pudendum includes all the visible external genital organs in the perineum.

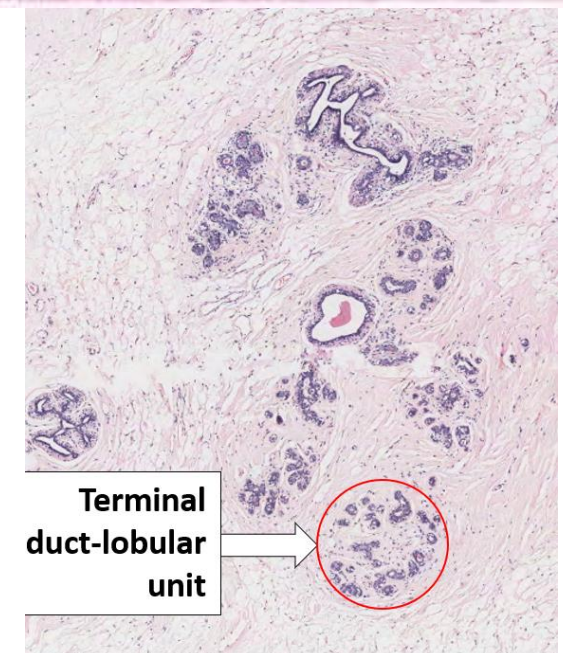
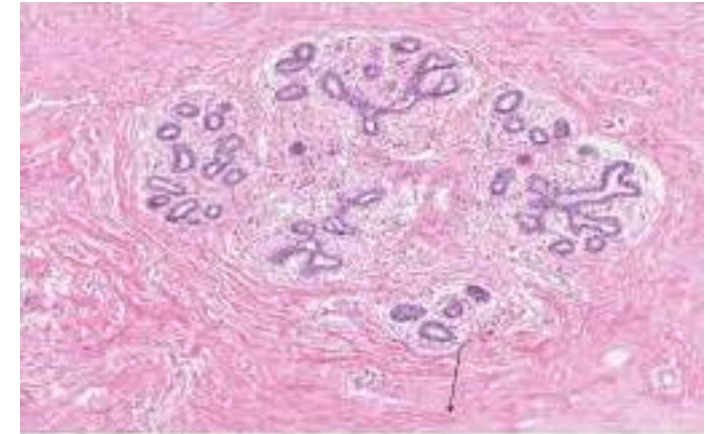
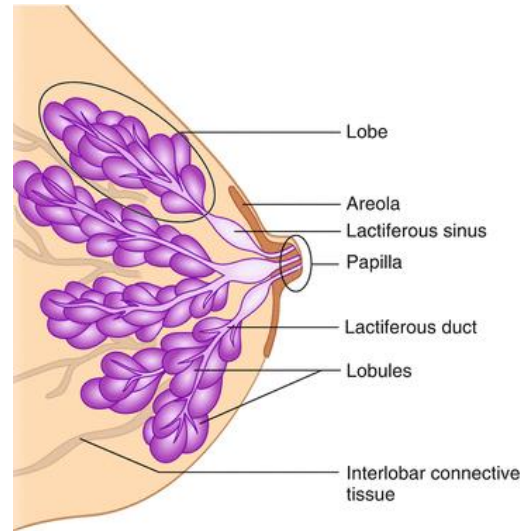
Vulva consists of the following:

- mons pubis
- labia majora
- labia minora
- Hymen
- Clitoris
- Vestibule
- vestibular bulbs
- urethra
- Skene's glands
- Bartholin's glands



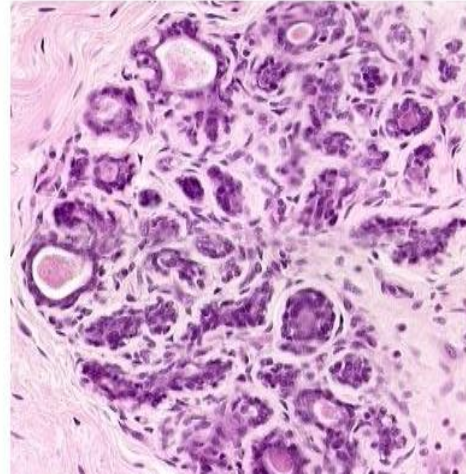
Breast

- In **girls** and **boys**:
 - Lactiferous sinuses
 - Very small branching ducts
- At **puberty**:
 - Ducts elongate
 - Adipose tissue deposition (estrogen)
- **Adult (non-pregnant)**
 - Many lobules
 - Each lobule consists of small, branching ducts with rudimentary small secretory units

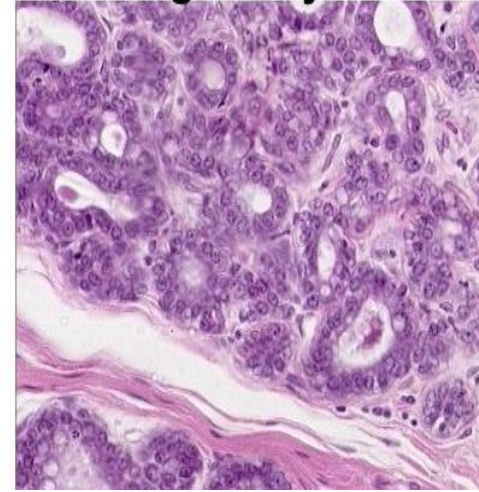


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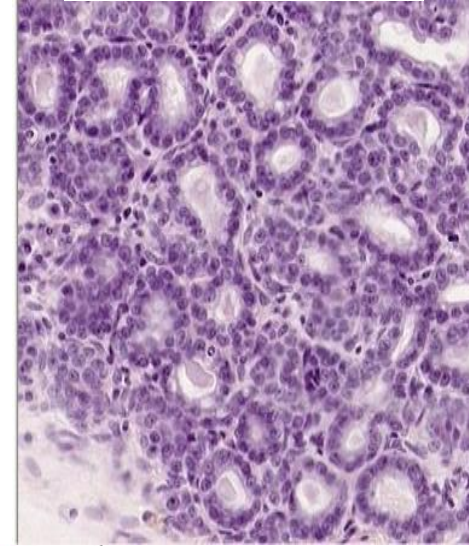
Inactive



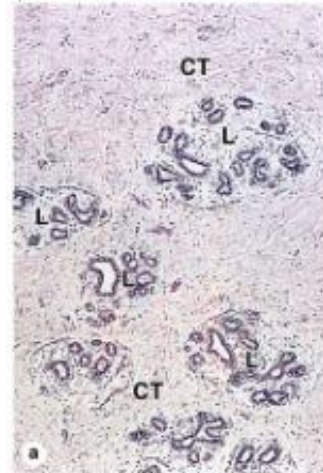
Pregnancy



Lactation

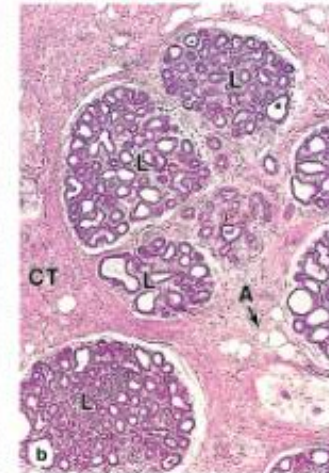


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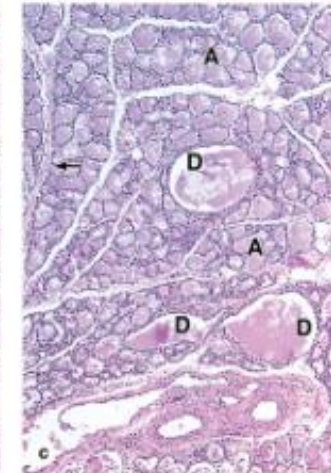
Small ducts, few lobules (L), mostly dense irregular connective tissue (CT)

Pregnancy



Growth of duct system, larger lobules that are extensively branched

Lactation



Enlarged lobules, lumens of alveoli (A) and ducts (D) filled with milk

Thank You