



# Female Reproductive System

By the end of this lecture, the student should be able to describe:

1. The Histological Structure And Fate Of Ovarian Follicles.
2. The Histological Structure Of:
  - Ovary.
  - Oviducts (Fallopian tubes).
  - Uterus.
  - Vagina.
  - Placenta.
  - Resting and lactating mammary gland.

**Color index:**

Slides.. Important ..Notes ..Extra..

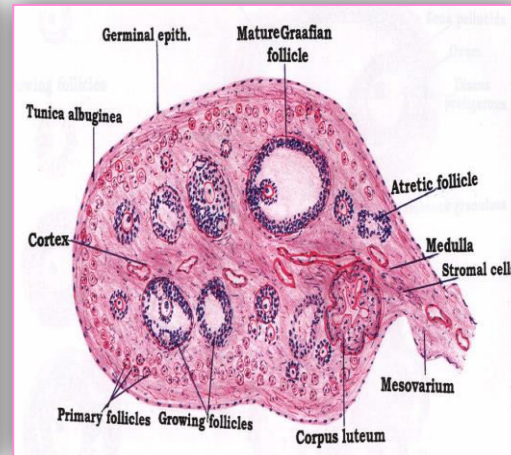
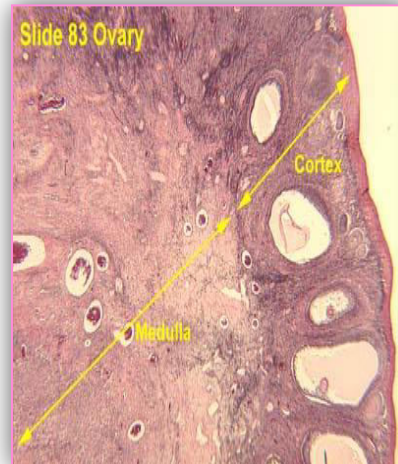
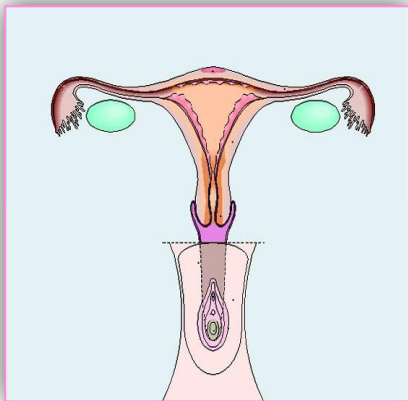
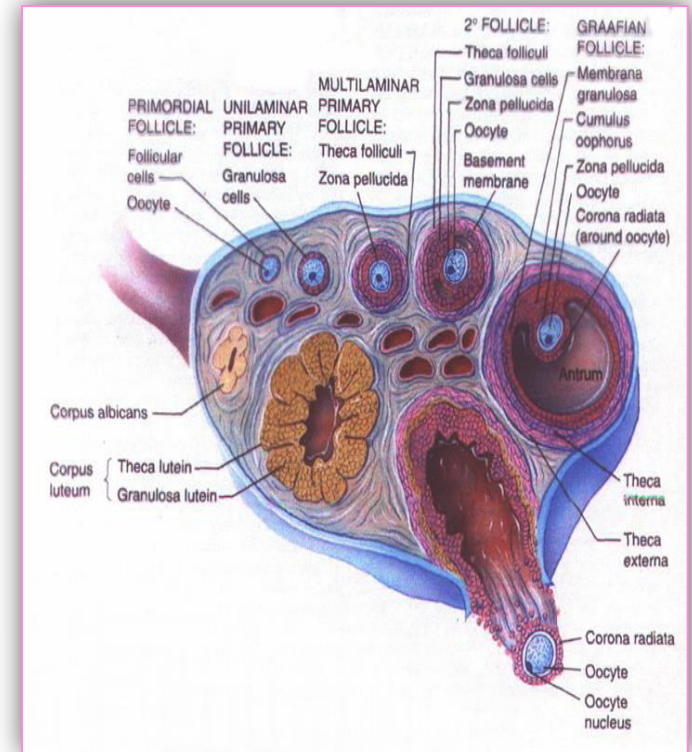
# Female Reproductive System

- **Primary sex organs:**
  - 2 ovaries.
- **Secondary sex organs:**
  - 2 Fallopian tubes.
  - Uterus.
  - Vagina.
  - External genitalia.
  - 2 mammary glands.

# Adult Ovary

1. **Germinal Epithelium:** outer layer of flat cells.
2. **Tunica Albuginea:** dense C.T layer. Thick capsule covering the ovaries
3. **Outer Cortex:** ovarian follicles and interstitial cells.
4. **Inner Medulla:** highly vascular loose C.T. Its thickness depends on age (pre or post menopausal) and does NOT contain follicles

# Ovarian Cycle: Overview



All the changes happening in the follicle are in:

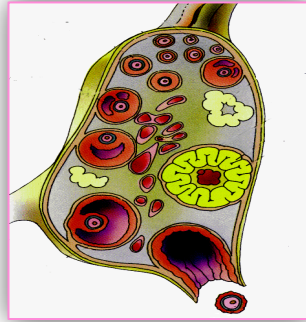
- 1) size of oocytes
- 2) cells surrounding the oocytes



# Ovarian Follicles

❑ The **cortex** of the ovary in adults contains the following types (stages) of follicles:

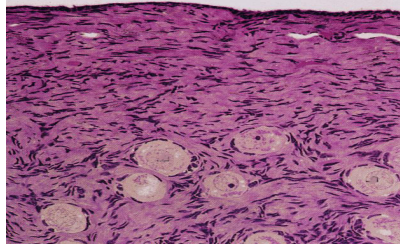
1. PRIMORDIAL follicles.
2. PRIMARY follicles:
  - A. Unilaminar
  - B. Multilaminar
3. SECONDARY (ANTRAL) follicles.
4. MATURE Graafian follicles.



## 1. Primordial Follicles:

- The **only follicles present before puberty.**
- The earliest and most numerous stage.
- Located superficially under the tunica albuginea.
- Each is formed of a primary oocyte (25  $\mu\text{m}$ ), surrounded by a single layer of flat follicular cells.

the nuclei around the follicle are forming only one layer of cells



## 2. PRIMARY Follicles:

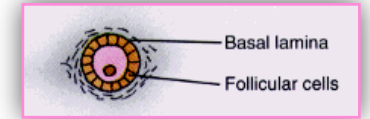
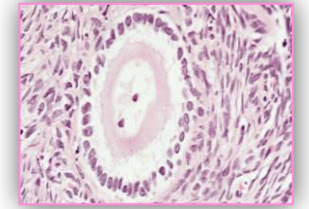
- They develop from the primordial follicles, at puberty under the effect of FSH.

### A. Unilaminar primary follicles:

Are similar to primordial follicles, but:

- The primary oocyte is larger (40  $\mu\text{m}$ ).
- The follicular cells are cuboidal in shape.

one layer of cuboidal cells surrounding the oocytes  
nuclei here are becoming round, representing that in the cuboidal cells

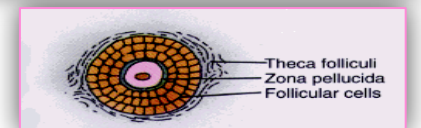


### B. Multilaminar primary follicles:

- 1ry oocyte larger
- Corona radiata
- Granulosa cells
- Zona pellucida
- Theca folliculi
- Follicular fluid (liquor folliculi)

more than one layer of cuboidal cells surrounding the oocytes,  
they could be as little as two layers

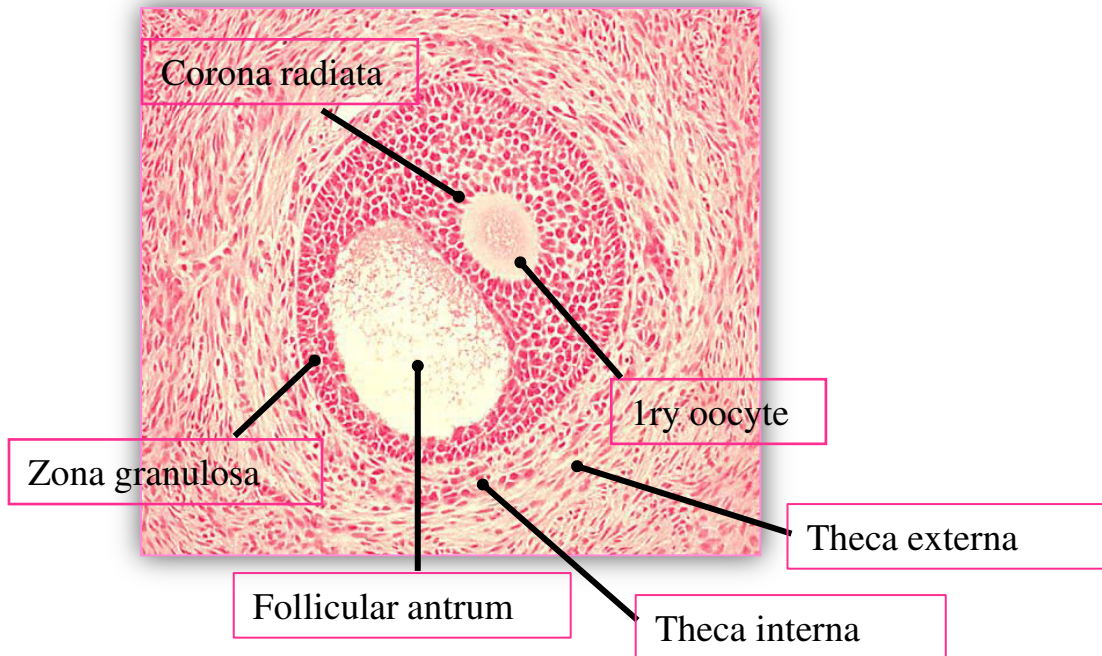
Theca lutein and granulosa lutein secrete estrogen and progesterone



# Ovarian Follicles cont.

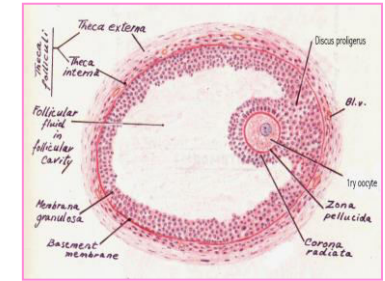
## 3. SECONDARY (ANTRAL) follicles:

- Multilaminar primary follicles become secondary follicles when a **complete antrum** filled with liquor folliculi is formed.
- 1ry oocyte is larger & pushed to one side.
- Theca folliculi differentiates into **theca interna** and **theca externa**.

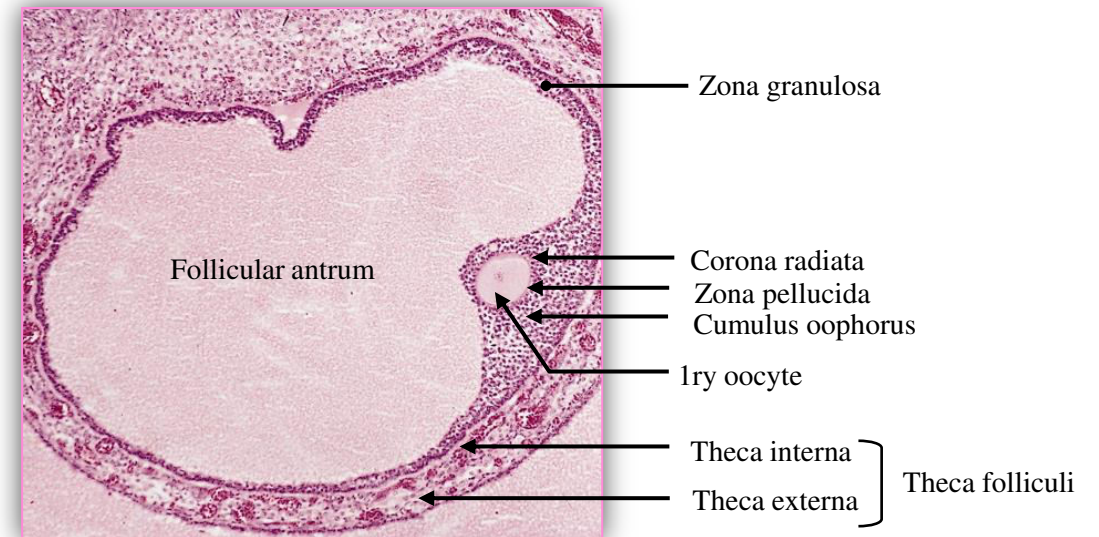


## 4. Mature (Graafian) Follicle:

- Large, thin walled
- Wide follicular antrum
- Large 1ry oocyte
- Zona pellucida
- Corona radiata
- Cumulus oophorus
- Zona granulosa
- Basement membrane which separates granulosa (follicular / epithelial part) from the theca cells which is considered as C.T.
- Theca folliculi: theca interna & theca externa



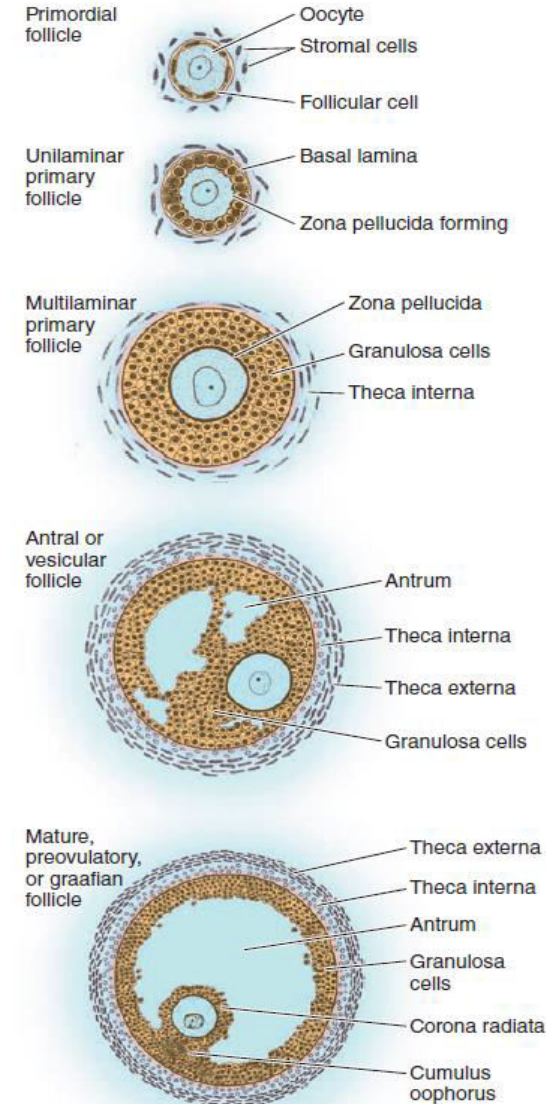
has no surrounding capsule making it easier to rupture





# Ovarian Follicles cont.

- The more mature the follicle the closer it is to the wall of the ovary
- You know the maturity of the follicle by the presence of large amount of fluid
- In graafian follicle: **the membrane granulosa cells are different than that in the corpus luteum (\*YOU NEED TO DIFFERENTIATE)**
- The graafian follicle contains thinner cuboidal cells to be easily ruptured, and it has an antrum full of fluid زي البلونة تمتلي لين تنفجر
- this fluid is produced normally by the **granulosa cell**, but the difference here is that it is collected together in a single place which is the antrum اقرأوا وطالعوا بالصورة عشان تقارنون
- After the follicle ruptures, the oocytes and the cells surrounding them (corona radiata) go out of the ovary and the cells that are present in the follicle are called **granulosa lutein cells** become endocrine cells producing hormones until the follicle shrinks and forms corpus albicans مهم نفرقون بينها وبين اللي قبل

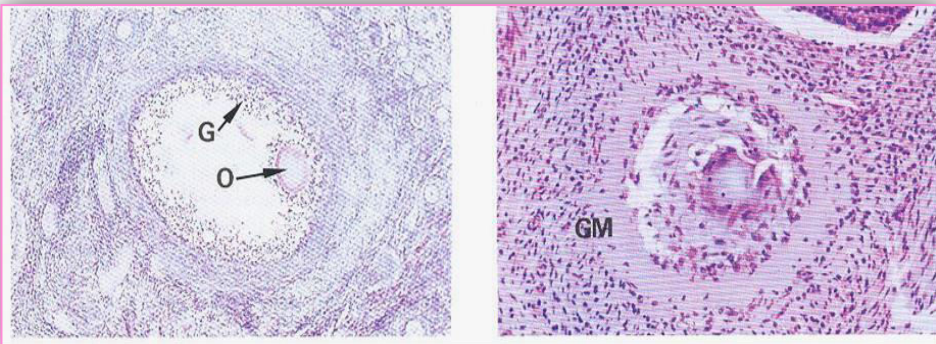


# Atretic Follicles

- During growth of the ovarian follicles, many of them do not reach maturation and they degenerate, and are finally replaced completely by fibrous tissue and are called atretic follicles or corpora atretica.

Atretic = Atrophy = Follicles that didn't complete maturation

These follicles secrete hormones for a short period of time before they shrink and form corpus albicans

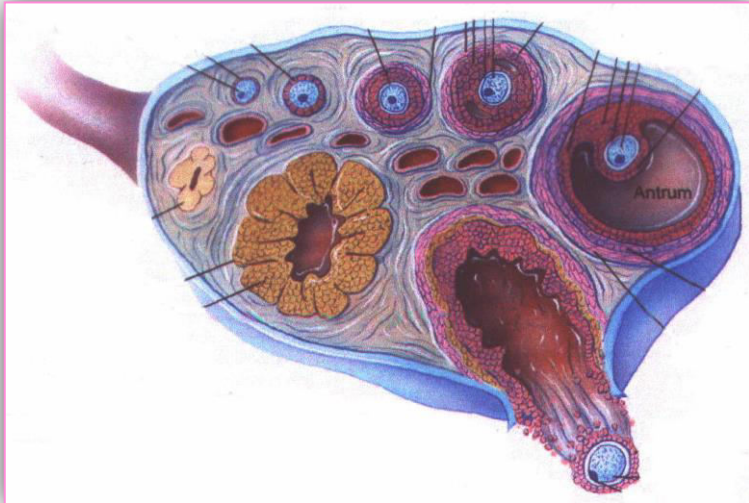


## Atretic follicle cont.

- You could be secreting as many as 1000 follicles:
- Then they decrease to 100, 10 of those one-hundred become uni-laminar follicles
- 8 of those uni-laminar become multi-laminar follicles, then 6 of those become secondary follicles and only one will mature to a Graafian follicle.
- The ones lost during these processes are called “atretic follicles” they secrete hormones for a short period then degenerate.

# Ovulation and Corpus Luteum Formation

- ❑ Ovulation occurs at day 14 of the cycle, under the effect of LH.  
(corpus luteum lives for 14 days)
- ❑ The follicle collapses and forms a corpus luteum.



## Ovulation and Corpus Luteum formation cont.

- The corpus luteum lives on for 14 days, if the female isn't pregnant it will become "corpus albican" > Remnants/scar.
- Then it will be phagocytosed by macrophages.
- During pregnancy; it lasts for 6 months, it will take up the majority of the ovary.
- In pregnant females, the corpus luteum lasts longer hence it will cause a larger scar than in a non-pregnant female.

# Corpus Luteum cont.

Zona granulosa → **granulosa lutein cells**.

Theca interna → **theca lutein cells**.

Bleeding may occur → corpus haemorrhagicum.

Fertilization → corpus luteum of pregnancy.

No fertilization → corpus luteum of menstruation.

At the end → corpus albicans.

❑ **Corpus luteum of menstruation** lasts about 10 days.

❑ **Corpus luteum of pregnancy** persists for six months.

❑ **Fate of corpus luteum:** formation of a white degenerated fibrous body, corpus albicans.

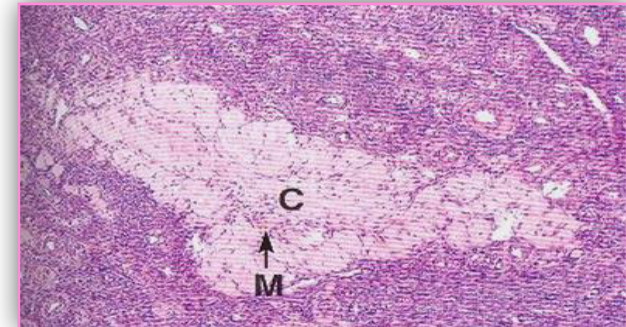
it forms corpus albicans but gives a larger scar due to its larger size

❑ **Function of corpus luteum:**

- Granulosa lutein cells: Secrete **Progesterone**.
- Theca lutein cells: Secrete **Estrogen**.

# Corpus Albicans

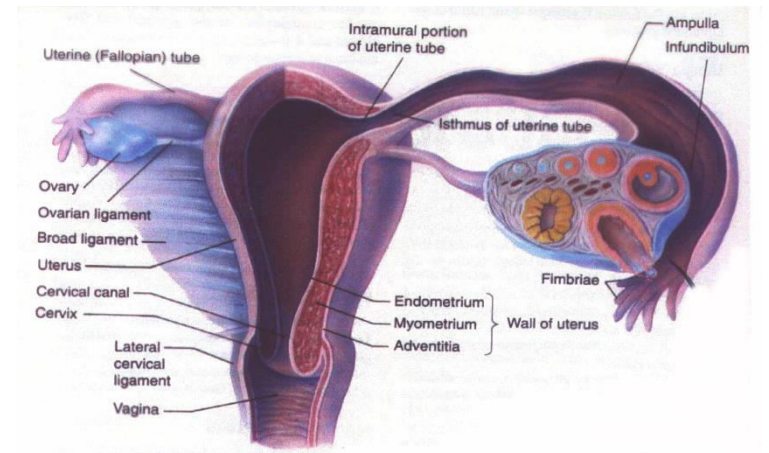
- ❑ It is a white degenerated fibrous body formed by involution of corpus luteum (degenerated corpus luteum).
- ❑ Secretory cells of corpus luteum degenerate and are phagocytosed by macrophages.





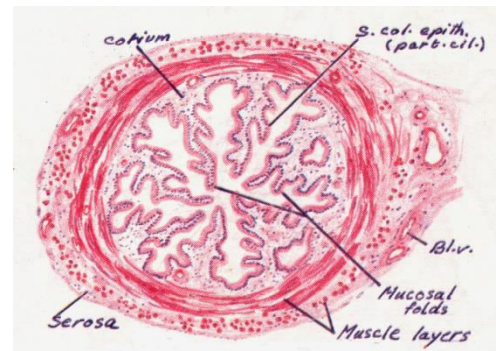
# OVIDUCTS (FALLOPIAN TUBES)

It has a peristaltic movement but not as strong as the uterus



## Mucosa

- Highly folded therefore it has a thin lumen
- Epithelium: Simple columnar partially ciliated.
- Corium of C.T.



## Musculosa

- Inner circular.
- Outer longitudinal.



**Serosa** because we have peritoneum covering it

## Ciliated cells:

- Non-secretory.
  - Cilia beat toward uterus
- They're responsible for the movement of the ova, but during fertilization the sperm will drift against the beat of the cilia.



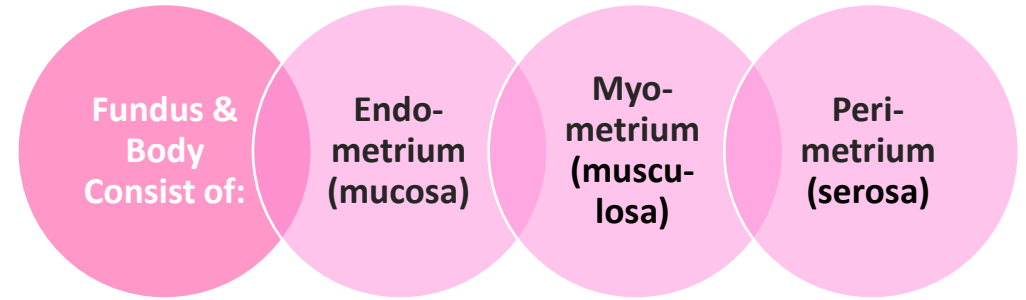
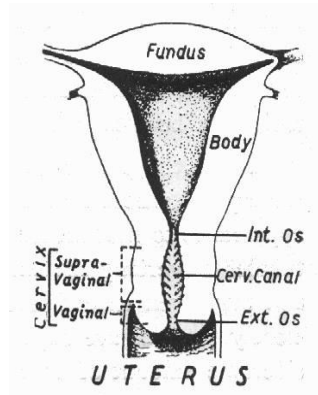
## Non-ciliated cells:

- Thinner, also called peg cells.
- Secretory cells.
- Apices bulge above ciliated cells.
- Their apices contain **nutritive material** to nourish gametes (ova and sperm) the sperm gets its strength from these material, so without it the sperm dies.

# Uterus

The vaginal end of the cervix has the same epithelium as that in the vagina.

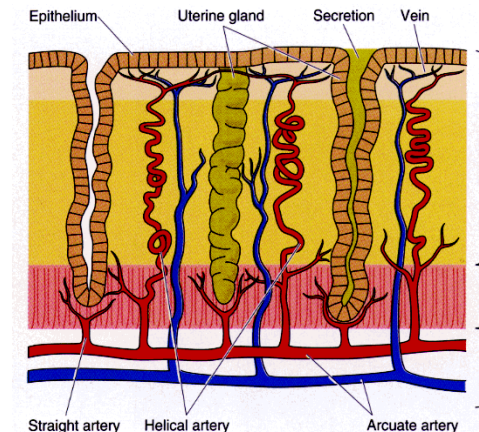
- Thick-walled **muscular organ**.
- Inverted pear shape.
- Anatomically:
  - **Body**: upper 2/3.
  - **Cervix**: lower 1/3.
  - **Fundus**: the rounded dome-shaped top of the body.



Coiled arteries become longer when the wall of the uterus thickens. During menstruation, only the **superficial part** detaches and not the **basal part**.

**Endometrium (mucosa):** has the same mucosa of the fallopian tube but not folded, only forms invaginations

Epithelium	Corium	Blood supply
simple columnar partially ciliated.	<ul style="list-style-type: none"> <li>• Endometrial glands: simple tubular.</li> <li>• Stromal cells.</li> <li>• Blood vessels.</li> <li>• Leukocytes.</li> <li>• Reticular fibers.</li> </ul>	<p>Two types of arteries derived from vessels in the myometrium:</p> <ul style="list-style-type: none"> <li>• <b>Coiled arteries:</b> Extend into the functional zone. Cyclic changes.</li> <li>• <b>Straight arteries:</b> Terminate in basal zone. No cyclic changes.</li> </ul>





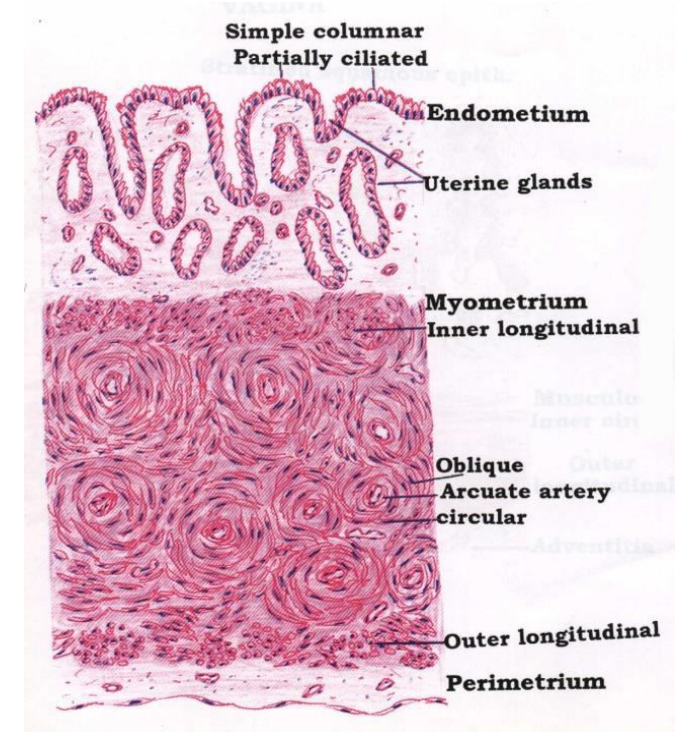
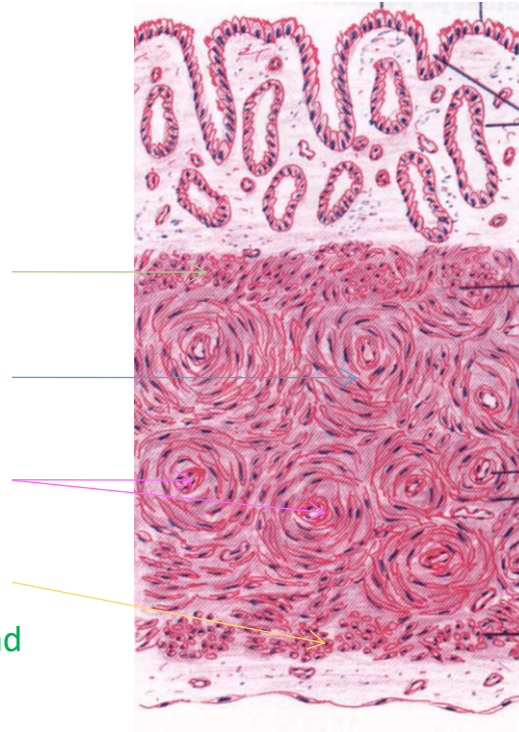
# Uterus cont...

## Myometrium (musculosa) Thickest layer

3 ill-defined smooth muscle layers:

- **Stratum submucosum**: longitudinal.
- **Stratum vasculare**: circular smooth muscle fibres in figure of 8 arrangement around large blood vessels.
- **Stratum supravasculare**: longitudinal

The circular muscles are important during menstruation and labor, because blood vessels are partially cut off and these muscles contract to close the vessels and prevent bleeding.



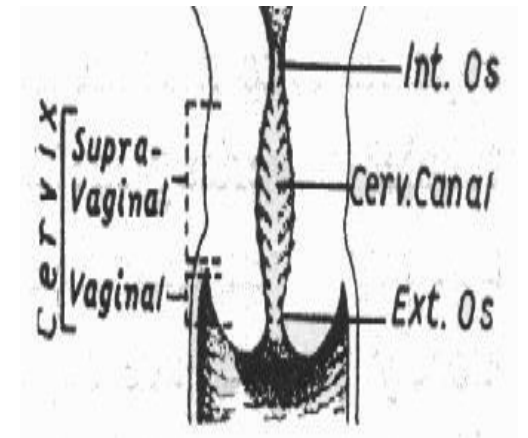
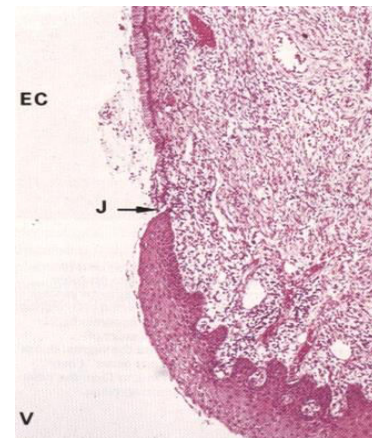
## Uterine Cervix

**Mucosa**: since a part of the cervix protrudes the vagina, they'll both have the same epithelium

- **Epithelium**: simple columnar in the cervical canal, but it changes to stratified squamous epith. (non-keratinized) at the external os.
- **Corium**: CT containing tubulo-alveolar glands.

## Substance of the cervix:

Dense fibrous tissue with few smooth muscle fibers





# Placenta

The placenta is a disk like structure present between the fetus and the mother

It is connected to the fetus by the umbilical cord and connected to the mother by penetrations to the uterus

Placenta has two parts:

- ✓ Maternal part (decidua basalis)
- ✓ Foetal part (chorionic villi )

## Foetal part (chorionic villi)

- Finger-like projections separated by intervillous spaces containing maternal blood.
- Each chorionic villus consists of:

Mesenchymal CT core containing fetal blood vessels.

Epithelial covering (trophoblast), made of 2 layers:  
 a) **Outer syncytiotrophoblast:** deeply stained with no cell boundaries.  
 b) **Inner cytotrophoblast:** disappears late in pregnancy

# Placental Barrier

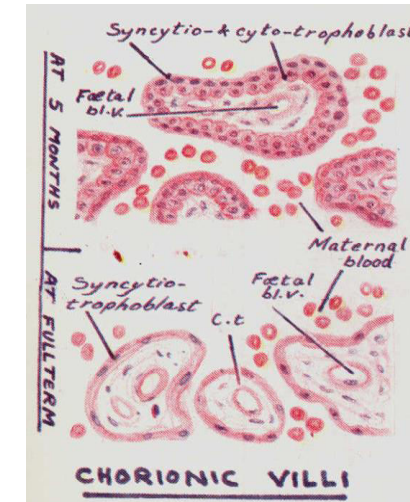
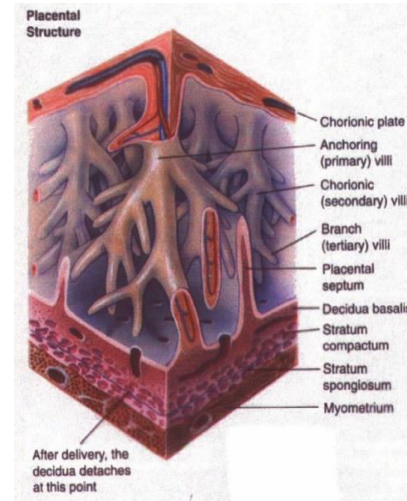
It is the barrier between the maternal and foetal blood.

It consists of:

- 1.The trophoblast covering the villus.
- 2.The basement membrane of the trophoblast.
- 3.The C.T. core of the villus.
- 4.The basement membrane of foetal capillaries.
- 5.The endothelium of foetal capillaries.

The fetal blood vessels are surrounded by trophoblasts forming a barrier that doesn't allow the passage of any materials.

But the maternal blood is exposed directly to the Chorionic villi without any barriers.

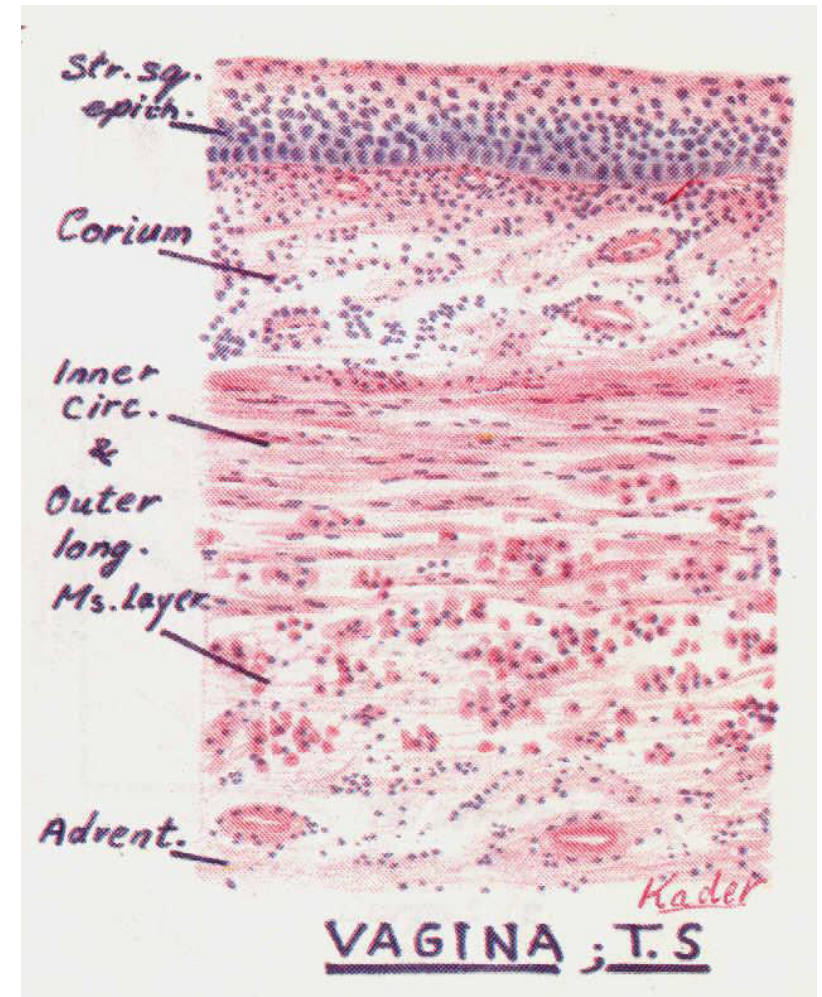


- **Syncytio-cyto-trophoblast** has no lateral boundaries but contains a basal part with cytoplasm.
- **Syncytio-trophoblast** contains mainly one layer and is found in the late periods of pregnancy.

# VAGINA

Mucosa	Musculosa	Adventitia
shows transverse folds and is made of: <b>Epithelium:</b> stratified squamous epithelium non-keratinized, rich in glycogen. <b>Corium:</b> of dense C.T., very rich in blood vessels, elastic fibres and leucocytes.	formed of interlacing inner circular and outer longitudinal layers of smooth muscle fibres.	formed of loose C.T.

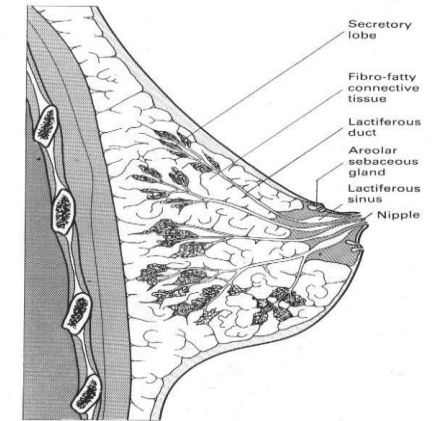
Source of wetness of the vagina: the uterus and blood vessels (by effusion)  
The vagina has an adventitia and not serosa because it is present in the pelvis which is not surrounded by peritoneum





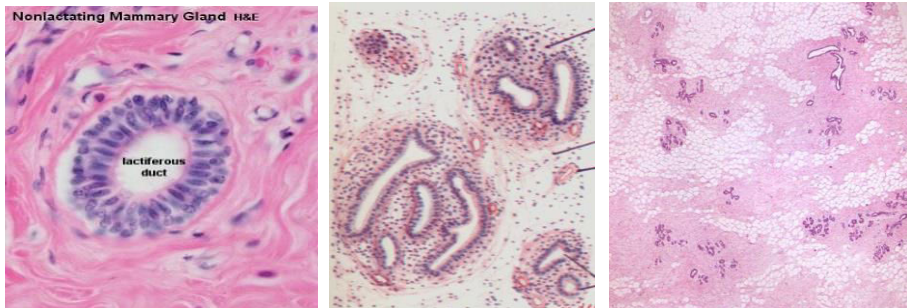
# MAMMARY GLAND

- ✓ At puberty they enlarge by accumulation of fat, but contain only a duct system.
- ✓ Secretory units appear only during pregnancy and are functioning only during lactation



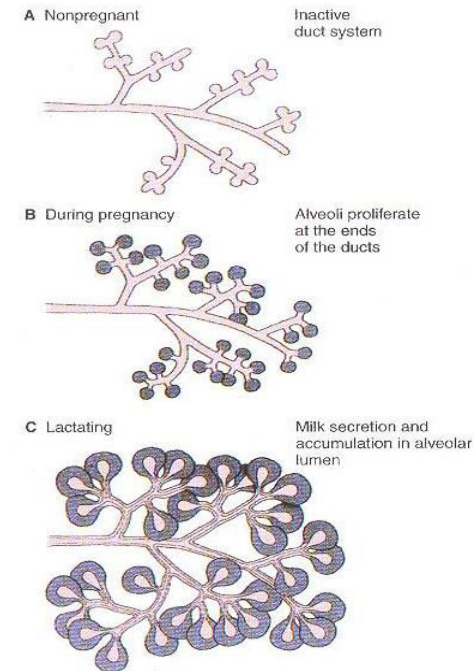
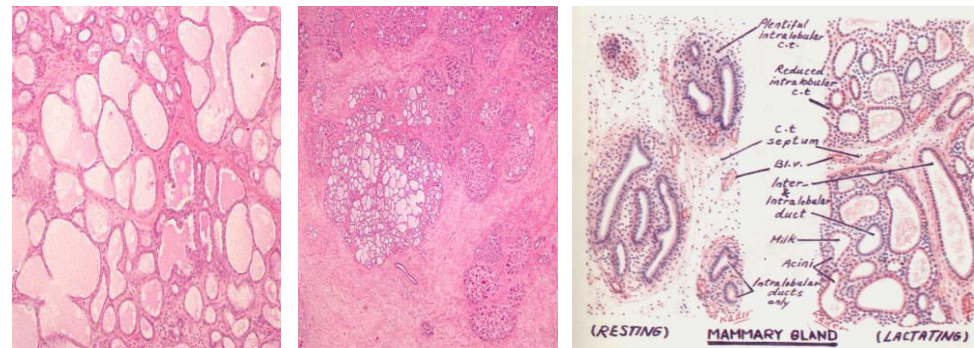
## Resting Mammary Gland:

- It is divided into lobes and lobules.
- The **interlobular** C.T. is dense and contains numerous fat cells.
- The **intralobular** C.T. is loose and contains no fat cells.
- Within the lobules, there are widely separated **ducts** lined by simple cuboidal epithelium.
- Ducts collect to form **lactiferous ducts** lined by stratified columnar epithelium and open at the top of the nipple.
- **Landmark: adipose tissue**



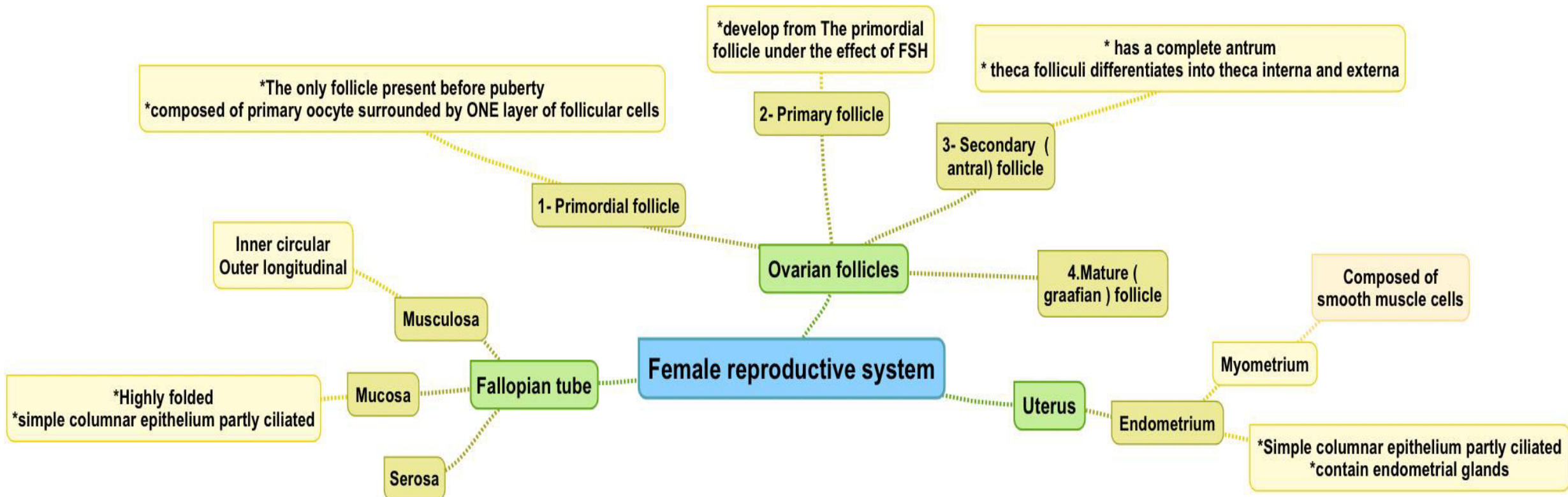
## Lactating Mammary Gland:

- Interlobular and intralobular C.T. become reduced.
- Lobules are made of ducts and alveoli.
- **Alveoli** are distended with milk and lined by cuboidal or flat cells surrounded by myoepithelial cells.
- **Milk** appears acidophilic with vacuoles of dissolved fat.
- **Less adipose, more milk with carbs and proteins.**



Milk accumulates distally so it can be excreted by myoepithelial cells, controlled by oxytocin.





**Female reproductive system**

**Ovarian follicles**

1- Primordial follicle

\*The only follicle present before puberty  
\*composed of primary oocyte surrounded by ONE layer of follicular cells

\*develop from The primordial follicle under the effect of FSH

2- Primary follicle

3- Secondary (antral) follicle

\* has a complete antrum  
\* theca folliculi differentiates into theca interna and externa

4. Mature (graafian) follicle

Inner circular  
Outer longitudinal

Musculosa

**Fallopian tube**

Mucosa

\*Highly folded  
\*simple columnar epithelium partly ciliated

Serosa

**Uterus**

Endometrium

\*Simple columnar epithelium partly ciliated  
\*contain endometrial glands

Myometrium

Composed of smooth muscle cells

## MCQs

1\The Primary sex organs are:

A-2 Fallopian tubes.

B-2 ovaries.

C-2 mammary glands.

2\The only follicles present before puberty:

A-Primordial follicles.

B-Primary follicles.

C-Mature graafian follicles.

3\They develop from the primordial follicles, at puberty under the effect of FSH:

A-Primary follicles.

B-Primordial follicles.

C-Mature graafian follicles.

4\the main Function of corpus luteum:

A-secrete estrogen.

B-secrete progesterone.

c-phagocytosis.

5\Non-Ciliated cells of fallopian tube:

A-called peg cells.

B-Secretory cells.

C-both a&b.

6\the epithelium cells of uterus are:

A-stratified squamous cells.

B-simple columnar partially ciliated.

C-simple columnar completely ciliated.

q-9

c-5

q-7

3-a

2-a

1-b



# Thank you & good luck

- Histology team

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## References:

- ✓ Females' and Males' slides.
- ✓ Doctors' notes

