The female Reproductive system

I-Primary sex organs

- Two ovaries

II- Secondary sex organs:

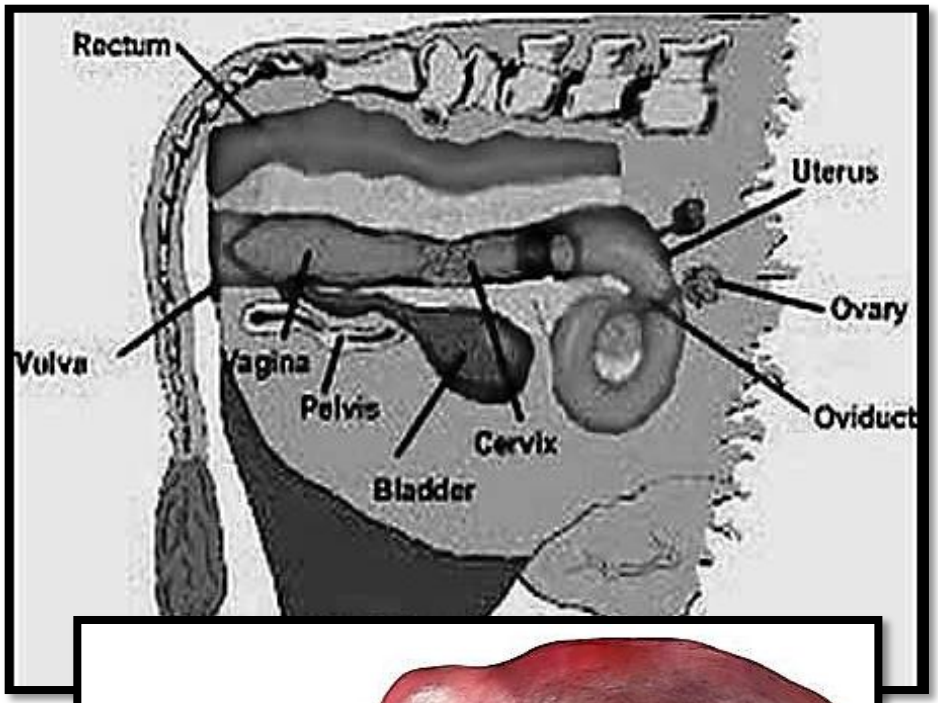
-Two uterine tube.

- uterus

-vagina

-external genitalia

I) Primary sex organs (The ovaries)



- Almond shaped bodies.

- The ovaries, except those of the mare are subdivided in to:

A) The ovarian cortex (zone parenchymatoza)

- It is the outer part of the ovary.

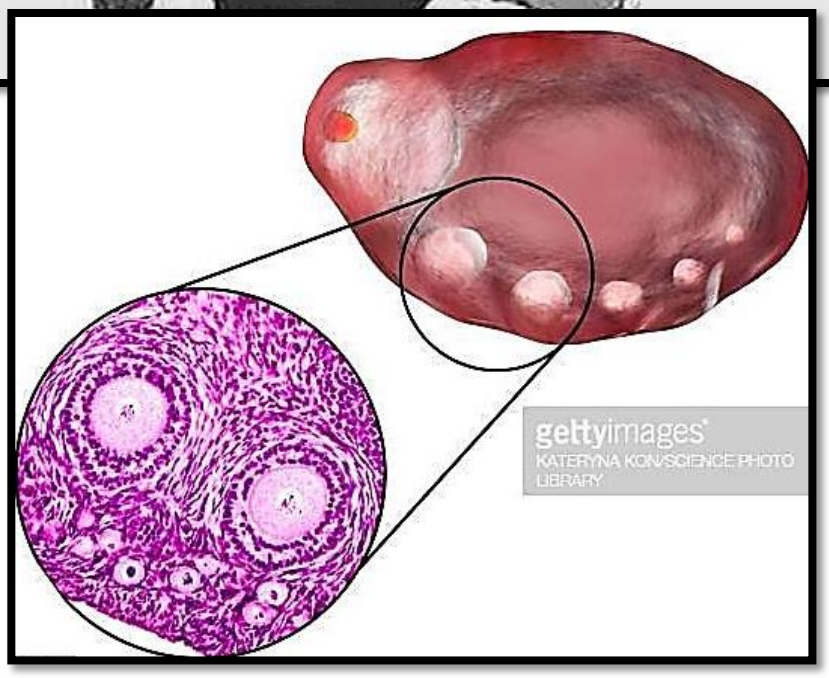
- It is formed of:

1- The germinl epithelium.

2- Tunica albuginea.

3- Follicles.

4- Corpus luteum.



B) The ovarian medulla (zona vasculosa):

- Inner part.

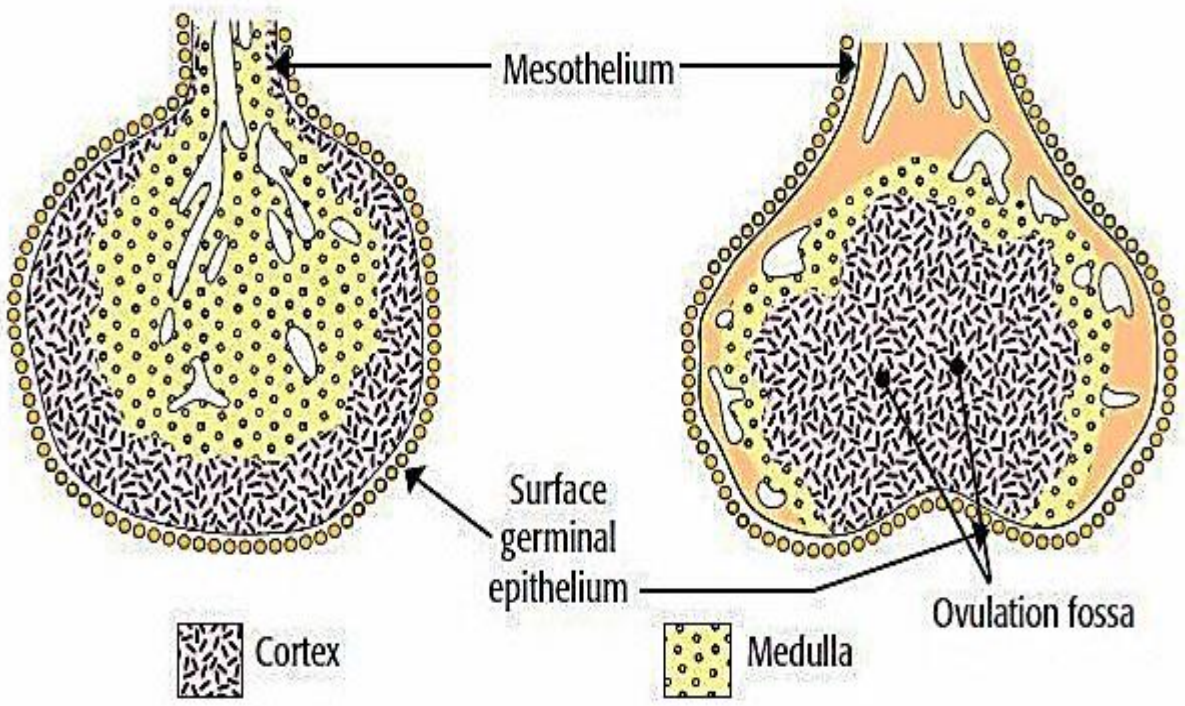
- It is formed of loose C.T containing large blood vessels, nerves & lymph vessels.
- There is strands of smooth muscle that are continuous with those in the mesovarium.

●Ovary of Mare:

- Germinal epithelium is localized at ovulation fossa.
- cortex is centrally located.
- medulla is peripherally located.

Ovary of all animal except mare

Ovary mare



A) The ovarian cortex:

1) The germinal epithelium:

- This consists of a simple cuboidal or squamous epithlelium on the surface of the ovary.

2) Tunica albuginea:

- Dense collagenous fibers contain few C.T. cells.
- Responsible for the whitish color of the ovary.

3) Follicels:

- Embedded in C.T. stroma of cortical tissue.

- The ovarian follicle is oocyte surrounded by specialized epithelial cells.

- The size, content and covering layers of the follicle vary depending on the stage of development.

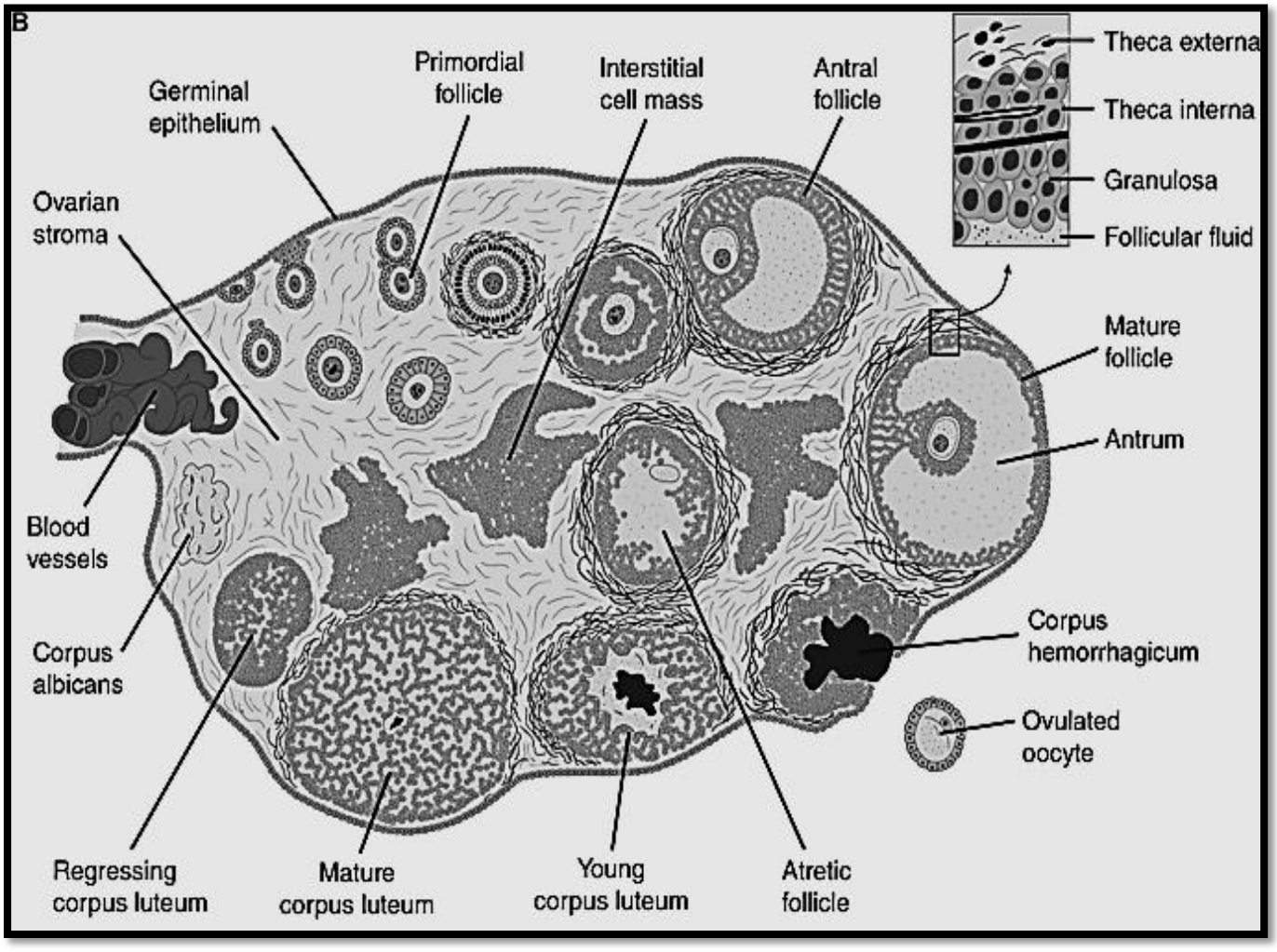
-There are different stage of development

1- Primordial follicles.

2- Primary follicles.

3- Growing follicles.

4- Mature ovarian follicle (Graafian follicle)



1- Primordial follicles:

- Primordial follicles are located mainly in the outer cortex.

- The primordial follicle formed of primary oocyte surrounded by a single layer of flat follicular cells

- They are evenly distributed in ruminants and the sow and occur in clusters in carnivores.

2- Primary follicles:

- Found mainly in an outer zone under the tunica albuginea.
- are composed of a primary oocyte surrounded by a simple cuboidal epithelium of follicular cells

3- Growing follicles = secondary follicles :

-The growing follicles are composed of a primary oocyte surrounded by a stratified epithelium of polyhedral follicular cells, termed granulosa cells

- The progressive development of the primary follies includes:

a- Change in the oocyte.

b- Changes in the follicular cells.

c- Change in the stroma cells.

a- changes in the occyte:

1- The oocyte increase in size.

2- Yolk granules appear in the cytoplasm of the oocyte.

3- a homogenous acidophilic membrane called Zonapellucida appears around the oocyte (Zonapellucida is a glycoprotein. Secreted by surrounding follicular cells & oocyte itself).

b- Changes in the follicular cells:

1- The cuboidal follicular cells around the primary follicles divide by mitotic divisions, increase in number & form a stratified epithelium around oocyte.

2- Follicualr fluid begins to accumulate in little poles in between the follicular epithelium.

3- The follicular fluid increase & small poles fuse with each other to form large cavity contains follicular fluid.

● **Follicular fluid:** contains components of the plasma & products secreted by follicular cells. Several protein & high concentration of steroid (progesterone, Androgen & estrogen) are present.

C- Changes in the stroma cells:

- The stroma cells surrounds the follicle & form a membrane called theca folliculi.

- This theca develops into:

1- The theca interna:

-More cellular

- An inner vascular layer with secretary cells.

2- The theca externa:

- More fibrous layer.

4- Mature ovarian follicle = Graafian follicle = follicle = Antral follicle:

_ occupies the whole surface of the cortex and bulges on the surface

- Characterized by the development of a central cavity (the antirum) contains follicular fluid.

- The wall of the mature ovarian follicle consists of the following layers from inside to outside.

1- Ovum (Secondary oocyte):

_ secondary oocyte with haploid number

_ The plasma membrane of the oocyte contains microvilli.

2- Zona pellucida (homogenous envelop):

- It is formed of glycoprotein membrane surround the oocyte

3- Corona radiate:

- It is composed of radially arranged columnar cells.

_ It has cytoplasmic processes which perforate zona pellucida and make contact with microvilli projecting from oocyte by gap junction.

- It supports & gives nutrition to the ovum.

- They are lost at time of ovulation in ruminants, but persist until just before fertilization in other species.

4- Zona granulosa:

- It is formed of 3-4 layers of polyhedral cells rests on basement membrane and lining the follicular cavity

_ secretes follicular fluid and Aromatase enzyme which converts androgen coming from theca interna into estrogen.

5- Cumulus oophorus:

- This is groups of cells around the corona radiate and separates the oocyte from the follicular fluid.

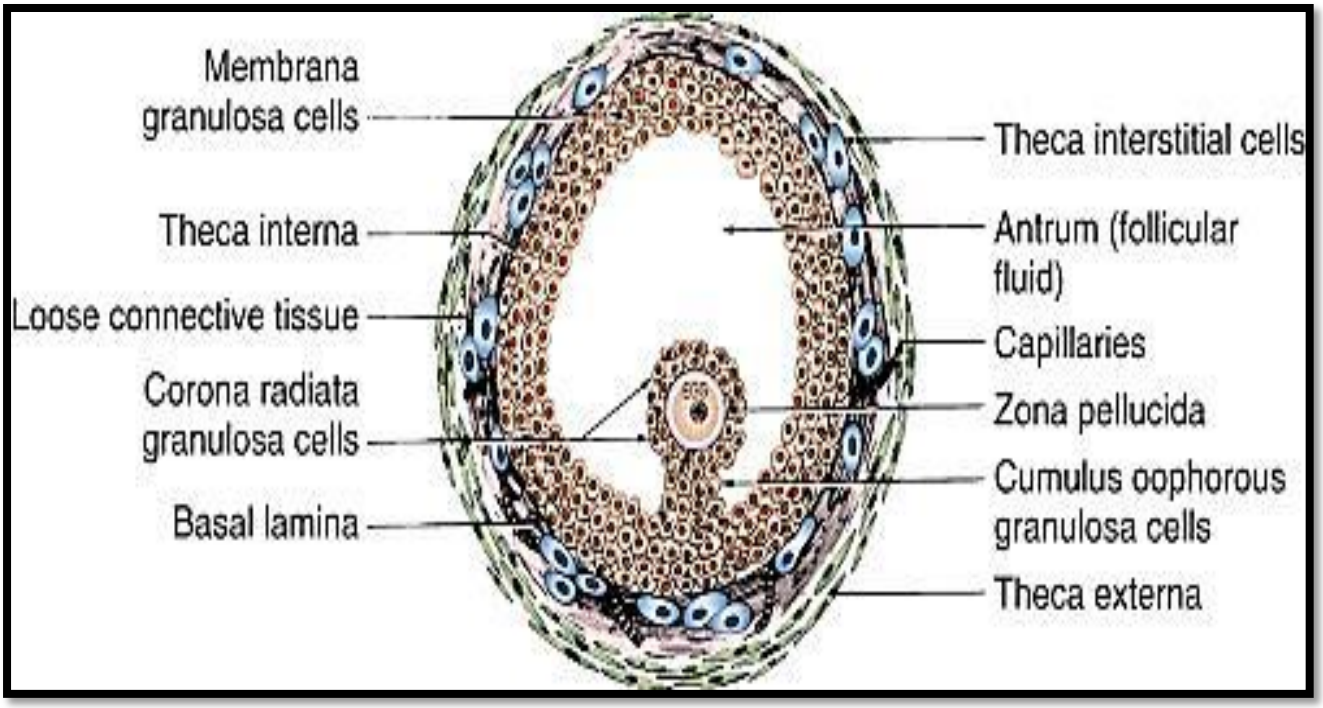
6- Basement membrane:

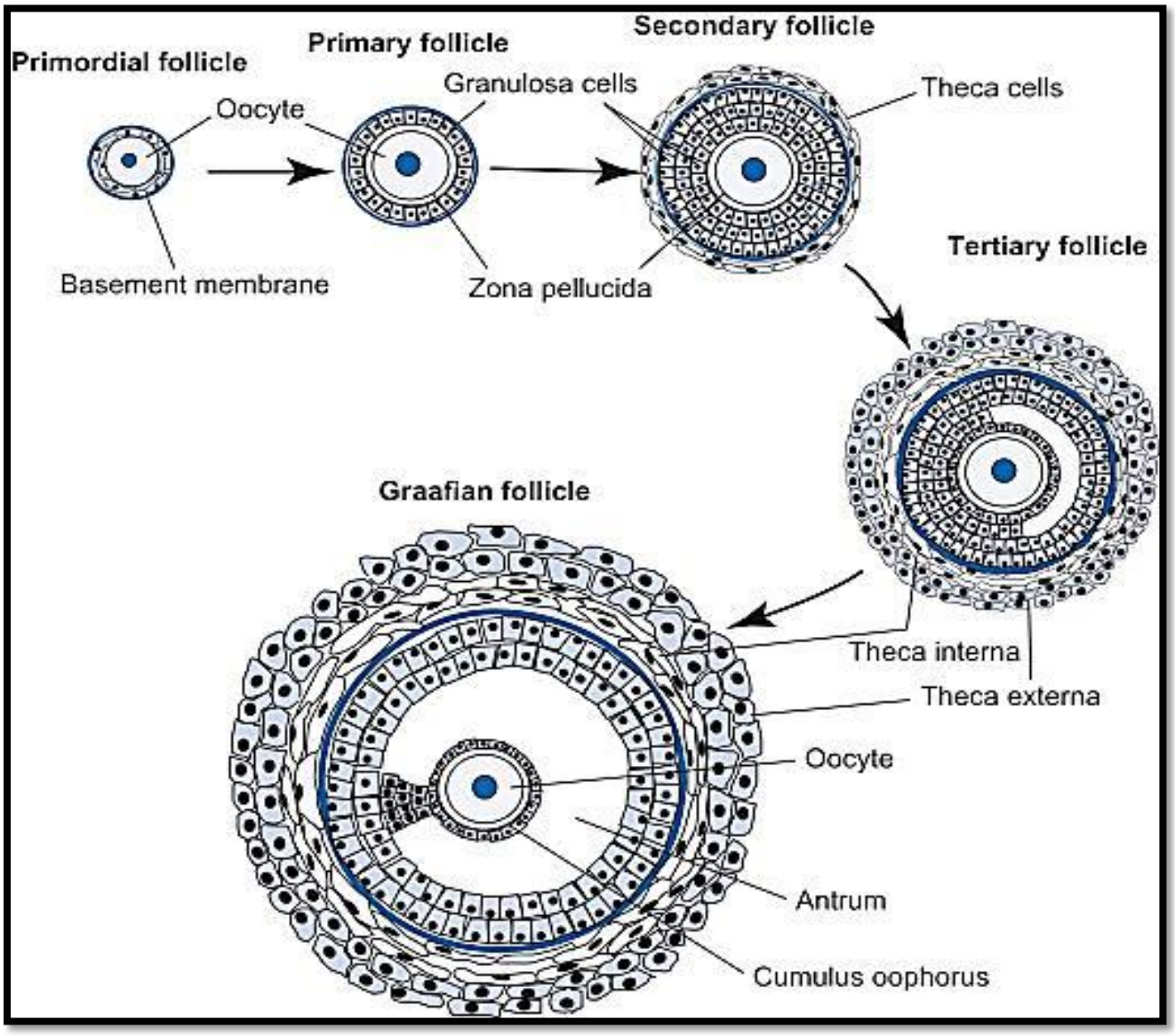
- Act as blood barrier and separate granulosa cells from theca folliculi.

7- Theca folliculi:

a-Theca interna: more vascular, more cellular and less fibrous

b- Theca externa: more fibrous, less vascular and less cellular





4- Corpus luteum:

- Glandular structure resulting from the rupture of the mature ovarian follicle.
- Embedded with in cortical region.
- Secrets: progesterone hormone.

1- After ovulation the follicular wall collapses & the granulosa forms large folds protruding into the residual lumen.

2- As the result of slight haemorrage which occur at time of ovulation, a blood clot is formed in the center (**corpus Haemorhagicum**).

3- Subsequently, the granulosa & theca interna cells proliferate with simultaneous accumulation of lipid droplets and arranged into cords and columns supported by delicate reticulum.

4- The granulosa cells are found in the center & referred to as granulosa lutein cells.

5- The theca cells are located at the periphery & are called theca lutein cells.

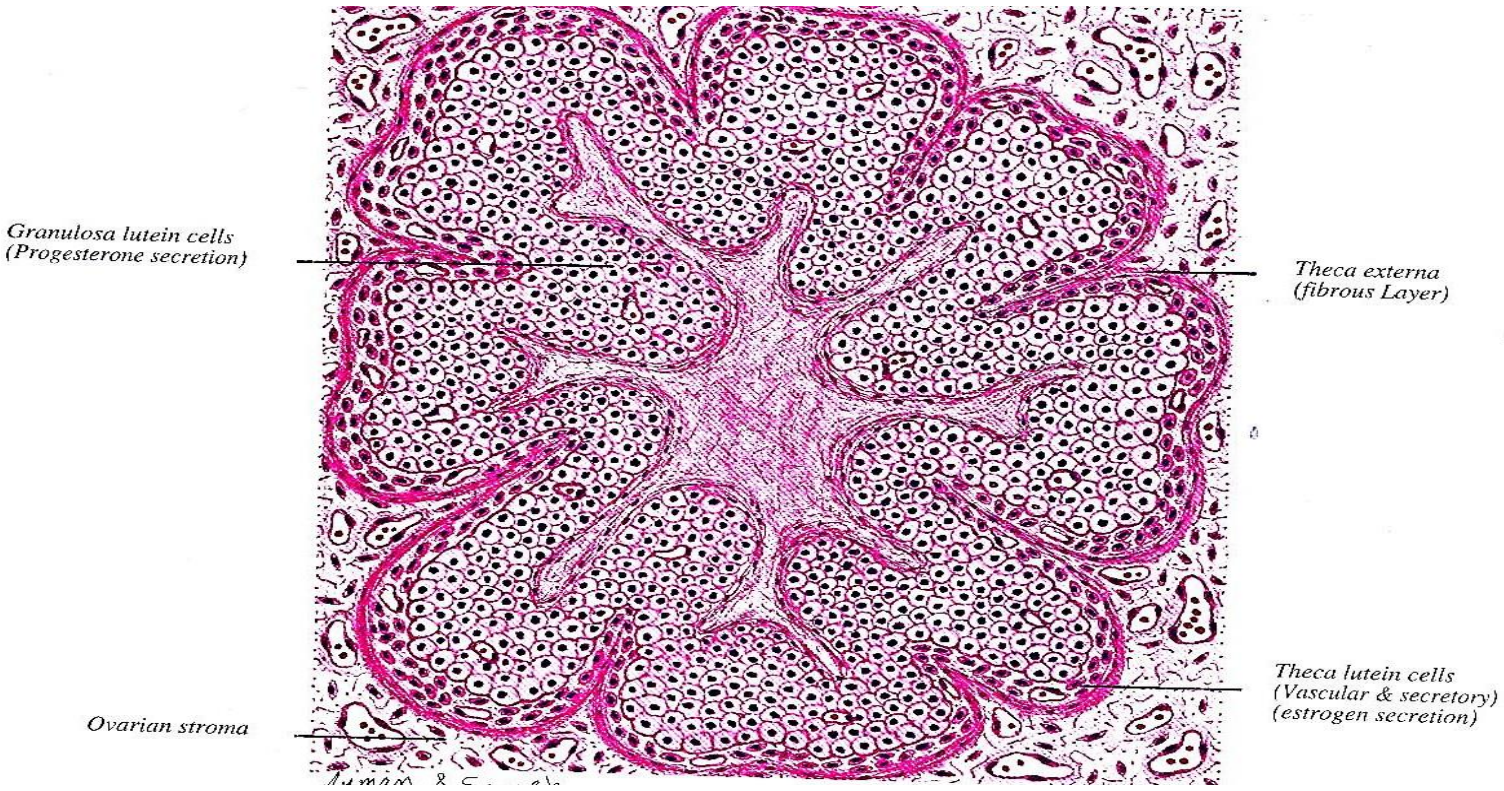
Theca lutein cells	**Granulosa lutein cells**
- Small polyhedral cells.	- Large polyhedral cells.
- Peripherally located	- Centrally located
- Nucleus is deeply stained.	- Nucleus is lightly stained.
- Cytoplasm is more acidophilic	- Cytoplasm is less acidophilic

- E/M: The cytoplasm of both cell types contains:

1- Well developed SER. (more in granulosa lutein cells).

2- Abundant mitochondrion (more in granulosa lutein cells).

3- Lipid droplets (more in granulos lutein cells).



● Types of corpora lutea:

1- Corpus Haemorragcum:

- Developing corpus luteum contained central blood clot.

2- Cropus luteum of the cycle:

- It develops if fertilization does not occur.

- It stays for short time then degenerates.

3- Corpus leteum of pregnancy:

- this type persists for most along the pregnancy period. It degenerates at the end of the pregnancy.

4- Corpus albicans:

- Formed of mass of fibrous tissue containing few lutein cells.

Interstitial cells:

-These are polyhedral cells containing large lipid inclusions.

-These cells are prominent in the ovaries of rodents and bitch.

-These cells secrete estrogen hormone

● Function of ovary:

1) Exocrine function: secret ova.

2) Endocrine function: It secret the steroid sex hormone:

1- Estrogen:

- From: mature follicle.
- Function: - induce the growth & development of the female reproductive tract & estrous behavior.
  - Promote mammary gland development.

2- Progesterone:

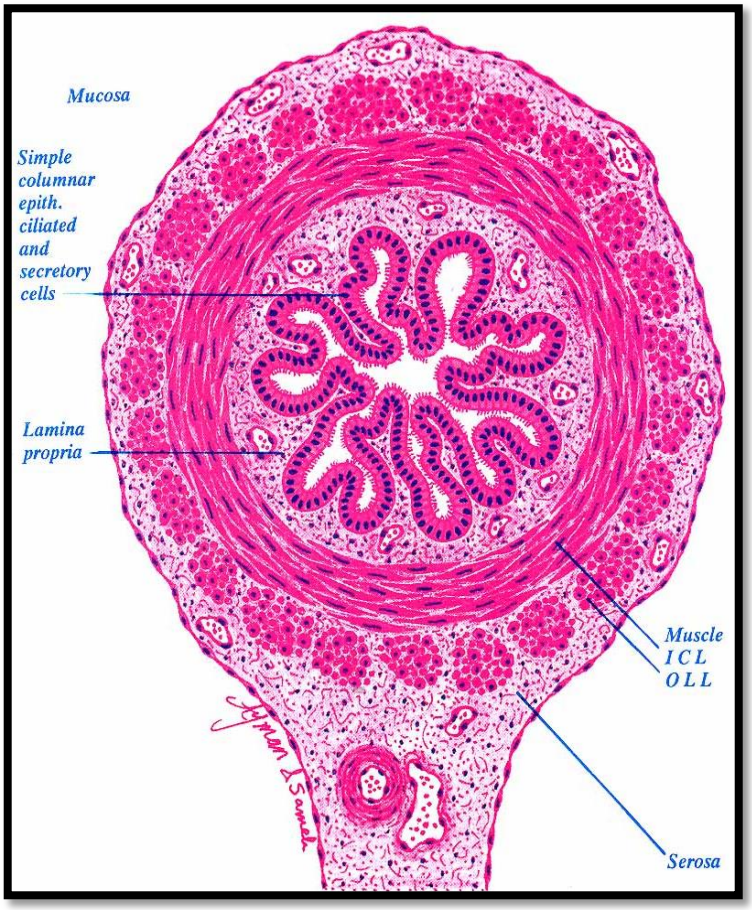
- From: luteal cells.
- Function: - Stimulates the development of uterine glands, induct

them to secret.

- Renders the endomterium receptive to the implantation of the zygote.
- Prevent follicular maturation & estrus & promotes behavior appropriate to pregnancy.
- Promote mammary gland development.

II) Secondary sex organs

a)Oviduct (The uterine tube)



- The uterine tube are bilateral, tortuous structures that extend from the region of the ovary to the uterine horns.

- Function:

1- Convey ova, spermatozoa & zygotes.

2- Fertilization take place on it (formation of zygote)

- Three segments of the uterine tube can be distinguished :

1- The infundibulum:

- a large funnel-shaped portion (with numerous fimbrae)

2- The ampulla:

- a thin walled section extending caudally from the infundibulum. (fertilization take place on it).

3- The isthmus:

- a narrow muscular segment joining the uterus.

- The wall of the uterine tube is made up of three layer:

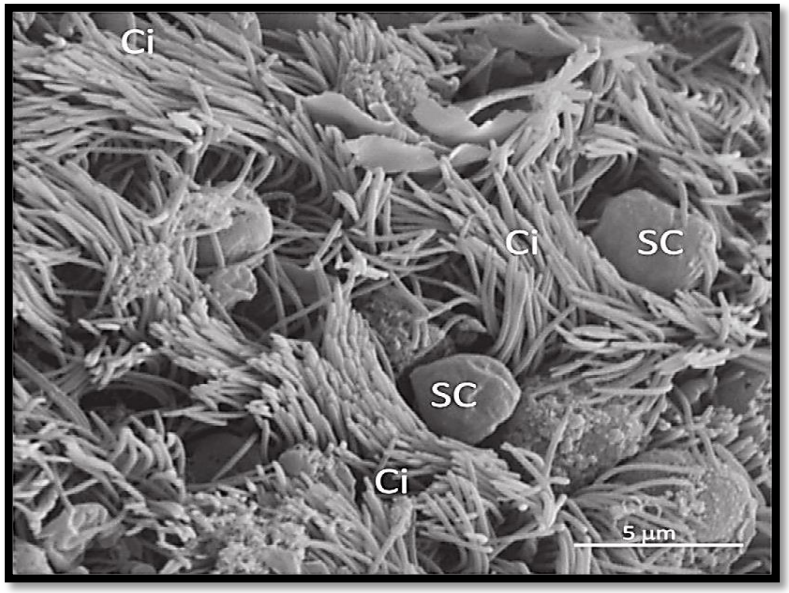
1- Tunica mucosa:

- highly folded specially at the ampulla, however, the mucosal folds are negligible at the isthmus region.

- The mucosal folds are most pronounced in sow & mare more than ruminants.

a- Lamina epithelialis:

- Is simple columnar, but in ruminants & swine patches of pseudo stratified columnar epithelium occur.



- Two types of cells are found:

1- Ciliated cells (motilie cilia):

- Which active in transport of ovum, they beat toward the uterus.

2- Secretary cells:

- give nutrition for the ovum.

- Both ciliated & non ciliated cell types posses microvilli.

b- Lamina propria – submucosa:

- Loose C.T containing smooth muscle fibers.

2- Tunica muscularis:

- Inner circular and outer longitudinal smooth muscle fibers.

- Thin in infundibulum & ampulla.

- Prominent in isthmus.

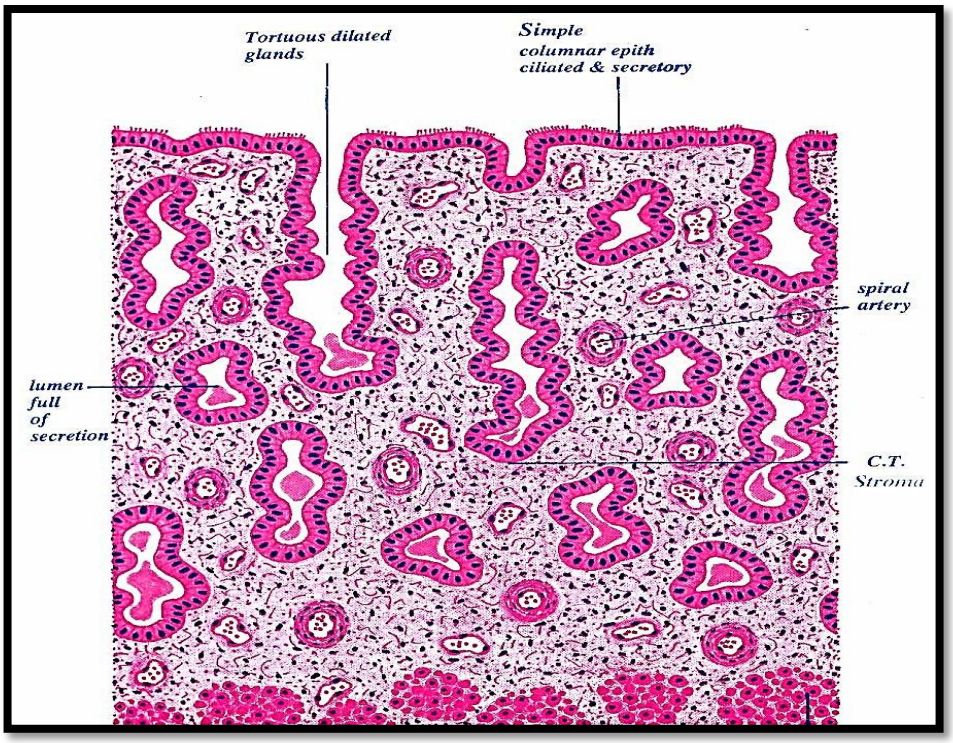
3- Serosa:

- C.T. with many blood vessels & nerves.

b-The uterus

- The uterus is the site of implantation of conceptus.

- In most species it consists of bilateral horns (cornua) connected to the uterine tubes, & unpaired body (corpus) & neck (cervix) which joins the vagina.



- The cervix will be considered separately.

- In primates, the entire uterus is a single tube called the uterus simplex.

- The wall of the uterus is formed of:

1- Endometrium = The mucosa submucosa.

2- Myometrium = The muscularis.

3- Perimetrium = The serosa.

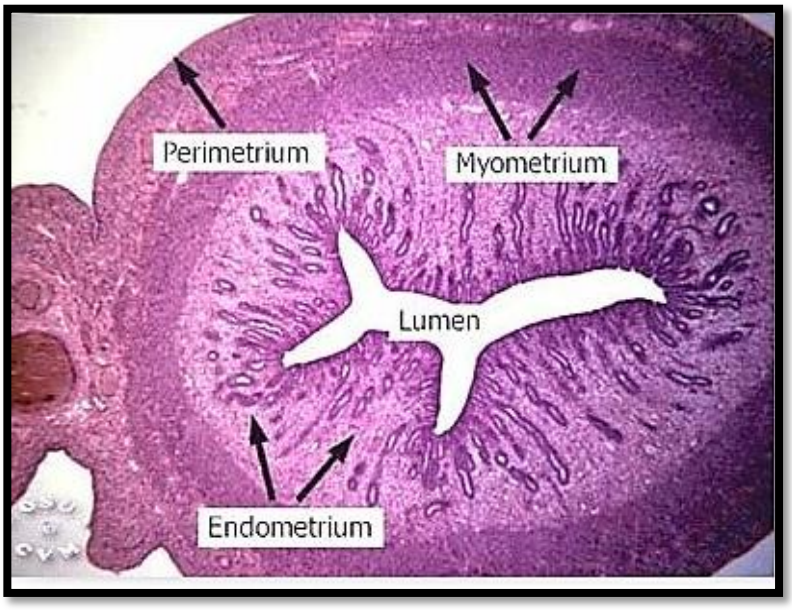
1- Endometrium = The mucosa submucosa:

a- Lamina epithelialis:

- Mare → simple columnar epithalium.

- bitch→ low columnar epithelium.

- Ruminants and swine → pseudostratified columnar epithelium.



- By E/M consists of:

1- Ciliated cells.

2- Secretory cells.

b- Lamina propria:

Formed of C.T layer rich in reticular fibers containing C.T. coils, blood vessels and uterine glands.

The uterine glands are blanched tubular glands.

- Less coiled and less branched in bitch.
- More coiled and more branched in mare.
- Highly coiled and highly b:anched in ruminants.
- Short and long uterine glands –are present in bitch during di-estrus and pregnancy.
- The uterine glands are lined with simple columnar epith, which undergoes marked changes during estrus cycle.

In ruminants the inner surface the, uterus contains non glandular projections called carancles

caruncles:

- Circumscribed thickenings of the propria – sub mucosa of uterus of ruminants.

- Non glandular, highly vascular, rich in fibroblasts.

- Four rows of approximately 15 caruncles each are presenting each uterine horn in ruminants.

- They are dom-shaped in cow & cup-shaped (i.e. dome with central depression) in the ewe.

- It represents the site of the attachment between the maternal and fetal placenta.

2- Myometrium:

- Smooth muscle fibers:

1- Inner circular : thick.

2- Outer longitudinal: thin.

- Both are separated by stratum vascularis (large arteries, veins & lymph vessels).

- In ruminants the stratum vascularis is found mostly in the outer portion of inner circular smooth muscle fibers.

3- Perimetrium:

- Consists of mesothelial cells resting on a thin layer of submesothelial loose C.T. layer.