

# **FOLLICULOGENESIS AND FOLLICULAR DYNAMICS**

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Ovaries lie in the pelvic cavity.

Paired organs

Has both exocrine (ovum release) and endocrine (steroidogenesis) functions.

At birth, a layer of follicular cells surrounds the primary oocytes in the ovary to form primordial follicles.

Shape and size of ovary varies with both species and stage of estrous cycle.



Epithelium covering the mammalian ovary is a single layer of cuboidal or low columnar cells called the germinal epithelium.

This layer covers the entire ovary except in mare, where it is limited to ovulation fossa.

Below germinal epithelium layer is tunica albuginea and then large mass of follicles.



# FOLLICLES

1. Primordial follicles
2. Primary follicles
3. Secondary / Growing follicles
4. Tertiary / Vesicular follicles
5. Graafian / Preovulatory follicles
6. Atretic follicles



# PRIMARY / PRIMODIAL FOLLICLES

It consists of an oocyte surrounded by a single layer of cuboidal granulosa (epithelial) cells, but no thecal layers.

At this stage, cow oocyte is 20 to 30 $\mu$  in diameter.

Ovary of a new born heifer may contain 1,50,000 follicles, which decreases to as few as 100 in cow of 15-20 years of age.

Only a few develop beyond this stage, as this is referred as resting stage and it may remain as such for few years without any growth.



# GROWING / SECONDARY FOLLICLES

Follicles that have left the resting stage as primordial follicles and have started growing, but have not developed thecal layer or antrum.

The epithelium shows mitotic activities and is growing.

Zona pellucida becomes more distinct.

The number of these follicles is relatively few, but by the onset of puberty as many as 2000 growing follicles are present in an individual bovine ovary.

Growing follicles are characterized by having two or more layers of follicle cells but without fully formed vesicle.



# TERTIARY / VESICULAR FOLLICLES

Pituitary gonadotropins (FSH and LH)



Liquor folliculi from granulosa cells



Accumulation in the intercellular spaces



Dissociation of granulosa cells



Formation of large, fluid-filled cavity  
(Antrum)



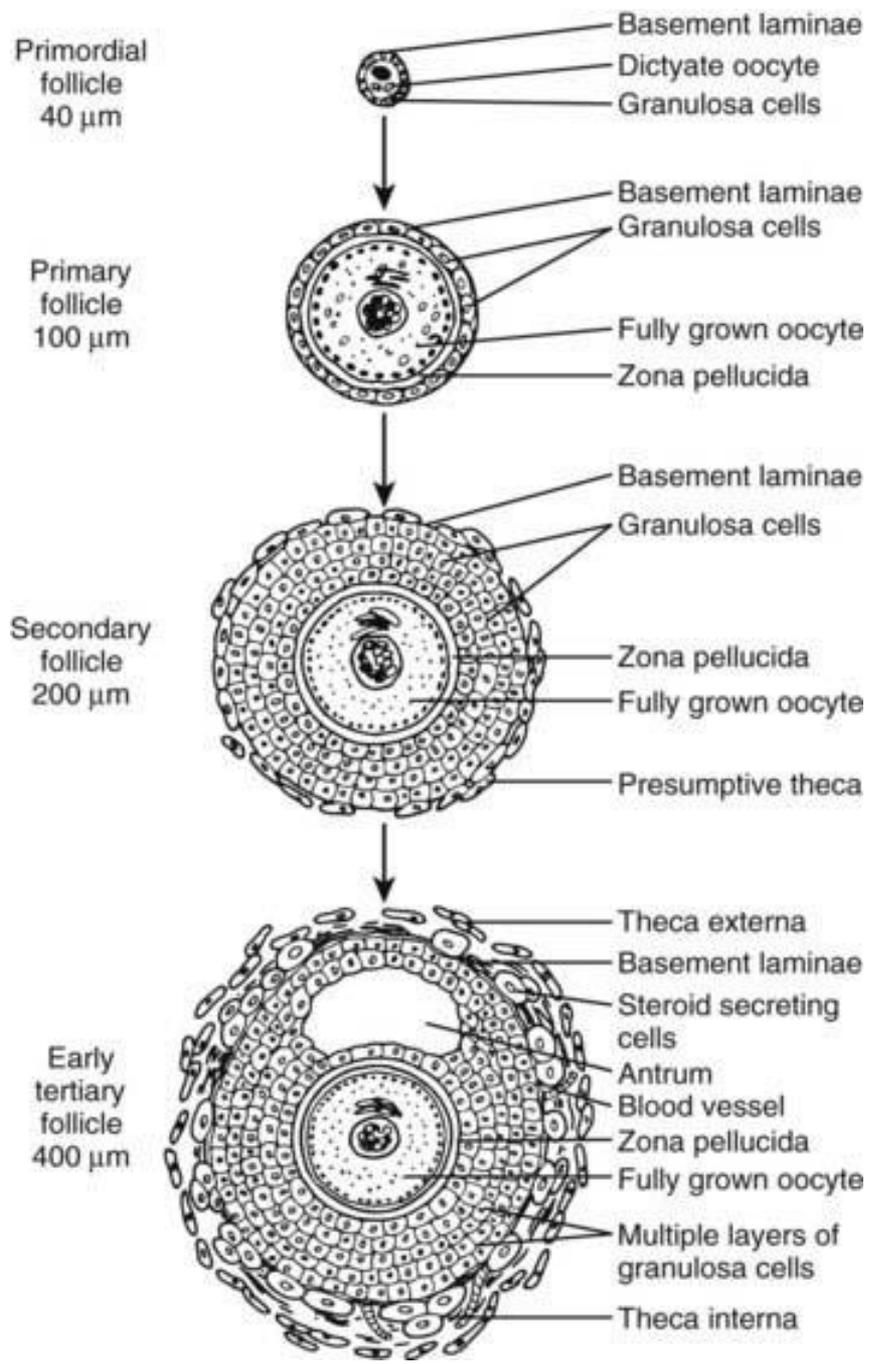
Zona pellucida is surrounded by a solid mass of radiating follicular cells, forming the **corona radiata**.

At this stage both functions of ovary i.e. steroidogenic and gametogenic are developing.

Growing/secondary follicles protrude from the surface of the ovary like a blister and is termed as mature follicle.

There is formation of two cell layers – theca interna and theca externa.





# GRAAFIAN FOLLICLE

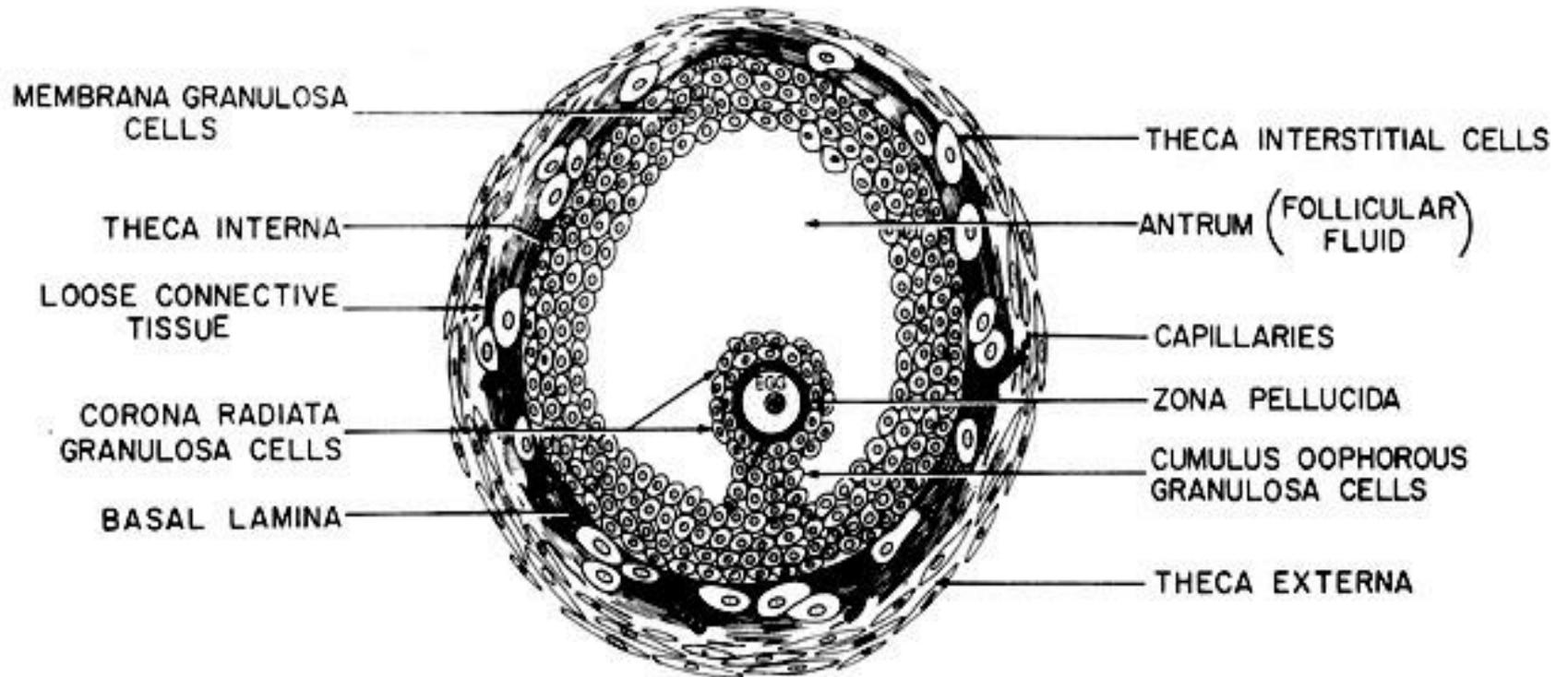
Follicular cells increase in size.

Oocyte pressed to one side, surrounded by accumulation of follicular cells (cumulus oophorus).

In the follicular cavity, an epithelium of fairly uniform thickness called the membrana granulosa is formed.



## HISTOLOGIC ARCHITECTURE OF GRAAFIAN FOLLICLE



# PREOVULATORY FOLLICLE

Blister—like structure protruding from ovarian surface due to rapid accumulation of follicular fluid / thinning of the granulosa layer.

Oocyte, in prophase of meiosis, resumes several hours before ovulation.

First meiotic (maturation) division associated with extrusion of first polar body.



# ATRETIC FOLLICLES

Result from follicles that do not ovulate.

Also referred as degenerating or anovular follicles.



# FOLLICULAR FLUID

Originates mainly from the peripheral plasma by transudation across the follicle basement lamina and accumulates in the antrum.

Contains steroids and glycoproteins, synthesized by cell wall of the follicle, amino acids, enzymes, carbohydrates, salts, trace minerals, prostaglandins and most of them are in similar concentration as to blood serum.

In large antral follicles, the follicular fluid contains remarkably high levels of estradiol  $17\beta$  in follicular phase.

However, polycystic ovaries contain high level of androstenedione.



# FUNCTIONS OF FOLLICULAR FLUID

Follicular fluid performs several functions like:

1. Regulation of granulosa cells' function, initiation of follicular growth and steroidogenesis.
  2. Oocyte maturation, ovulation and egg transport to the oviduct.
  3. Prepares follicles for formation of corpus luteum.
  4. The stimulatory and inhibitory factors in the fluid regulates follicular cycle.
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# CORPUS LUTEUM



The growth of luteal cells is one of the fastest events known in biology, with in 3 to 4 days the blood clot is invaded by the new luteal cells so that the blood filled cavity loses its dark coloration.

CL is one of the most vascularized organs of the body.

Corpus luteum develops after the collapse of the follicle at ovulation.



Inner wall of follicle develops into macro and microscopic folds that penetrate the central cavity.

These folds consist of central core of stromal frame and large blood vessels, which becomes distended and cells develop a few days before ovulation.

They regress quickly and within few hours after ovulation all remaining thecal cells are in advanced stage of degeneration.

Hypertrophy and luteinization of granulosa cells begins after ovulation.



Luteal tissue enlarges mainly through hypertrophy of lutein cells.

Progesterone is secreted by the lutein cells as granules.

Generally the period of growth of C.L. is slightly longer than half of the estrous cycle.

In cow, the weight and progesterone content of CL increases rapidly between day 3 and 12 of the cycle and remains relatively constant till day 16, when regression begins, if fertilization does not take place.



# CORPUS ALBICANS



If fertilization does not occur, the CL regresses, allowing other layer of ovarian follicle to mature.

As these cells degenerate, the whole organ decreases in size, becomes white or pale brown, known as corpus albicans.

The remnants regress after 14 -15 days of estrus and reduced to half size in 36 hours but persist as a scar like structure for several successive cycles.

THANK  
YOU!

