

Development

Thanks عبير العضايلة for the diagrams and illustrations

A-Prenatal

occurring or existing **before birth**;
"the prenatal period"; "antenatal care"

= antenatal, antepartum

1-Pre-embryonic period

first 3 weeks after fertilization

- **Zygote** : the resultant cell of fertilization and the beginning of the human being.
- **Cleavage** : Mitotic divisions of the zygote.
- **Morula** : solid ball of cells (16 or more blastomers)
- **Morula** turns into Blastocyst in the uterus.

2-Embryonic period

Embryo

begins 4 weeks after fertilization to the 8th week.

composed of embryoblasts that forms the Bilaminar disc and extends to the 8th

3- Fetal period

from the 9th week until birth

Fetus

The use of the term "fetus" generally implies that an embryo has developed to the point of being recognizable as a human; *this is the point usually taken to be the ninth week after fertilization.*

A fetus is also characterized by the presence of all the major body organs, though they will not yet be fully developed and functional and some not yet situated in their final anatomical location.

Perinatal

Of, relating to, or being the period around childbirth, especially the five months before and one month after birth

perinatal mortality; perinatal care.

B-Postnatal period

- occurs after birth

= postpartum

Newborn (neonatal) is in the first 2 weeks

C-Infancy :from after birth till the first year

D-Childhood:

- The period from 15 months to 12-13 years
- Teeth are replaced by permanent ones
- Active ossification of the bones

E-Puberty:

In girls between 12-15
In boys between 13-16
Secondary sexual characteristics develop

Adolescence:

- The period of 3-4 years after puberty
- After sexual maturity until the attainment of physical, mental, and emotional maturity.

Adulthood

Early adulthood 18-25 years in which ossifications and growth is virtually completed
After that developmental changes occur very slowly leading to Senility (old age).

FEMALE REPRODUCTIVE SYSTEM

FEMALE REPRODUCTIVE SYSTEM

Organs of the **female reproductive system**

1-The ovaries (female gonads)

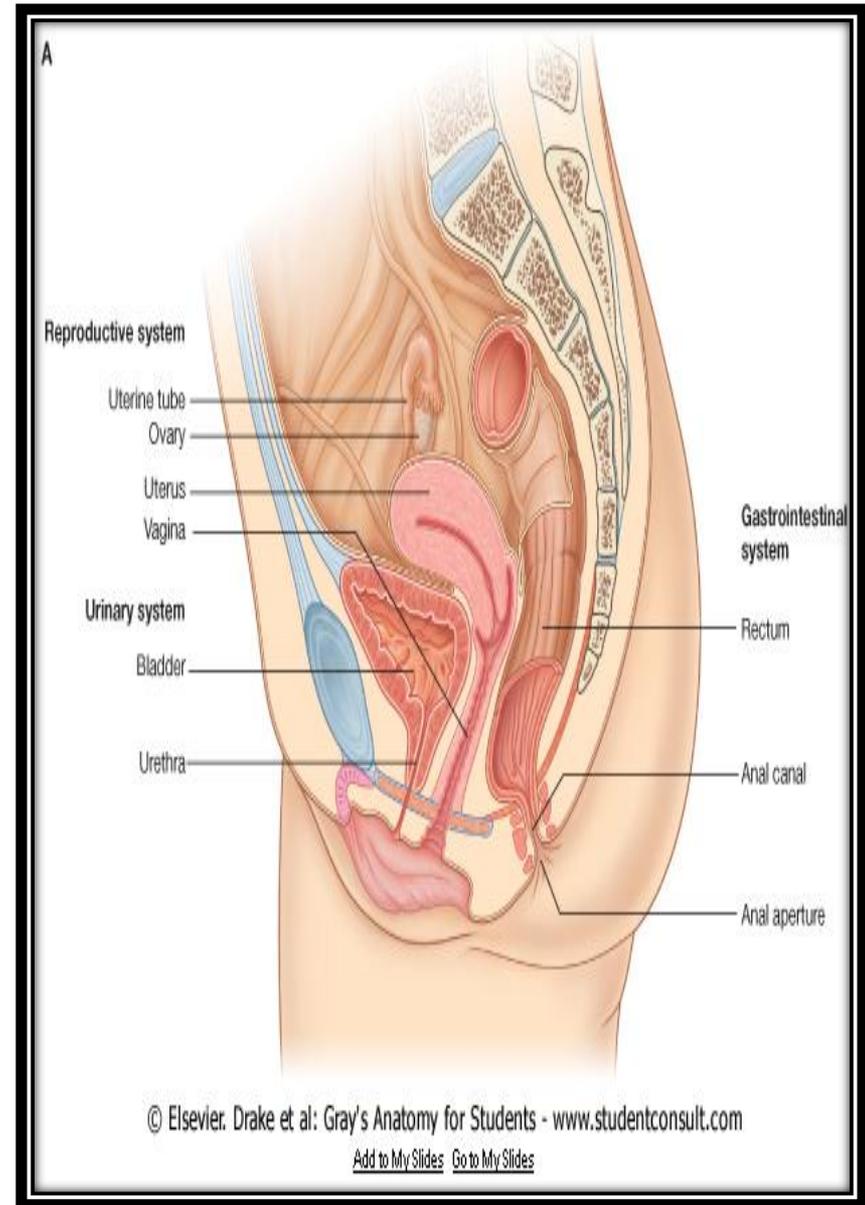
**2-The uterine (fallopian) tubes
or Oviducts**

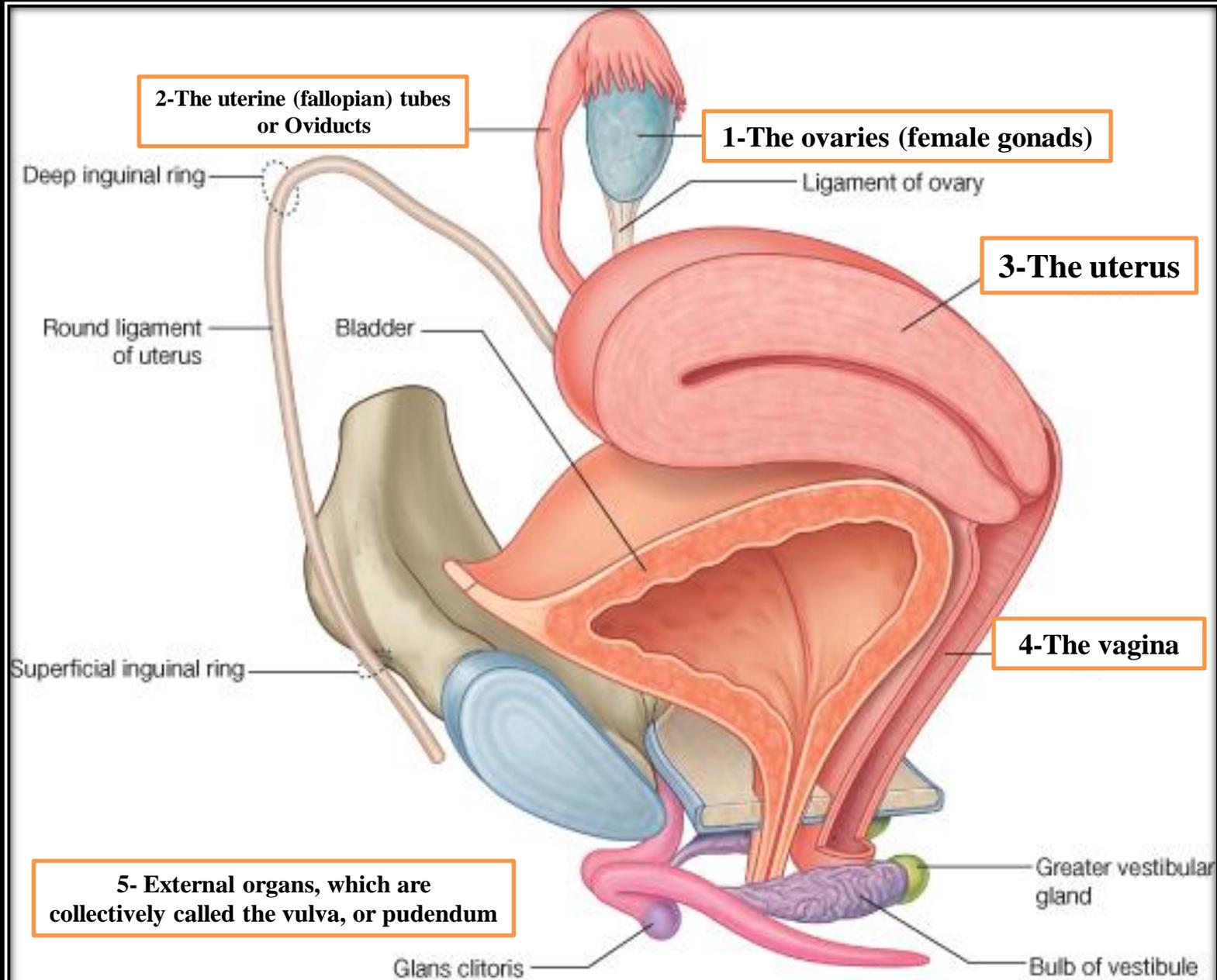
3-The uterus

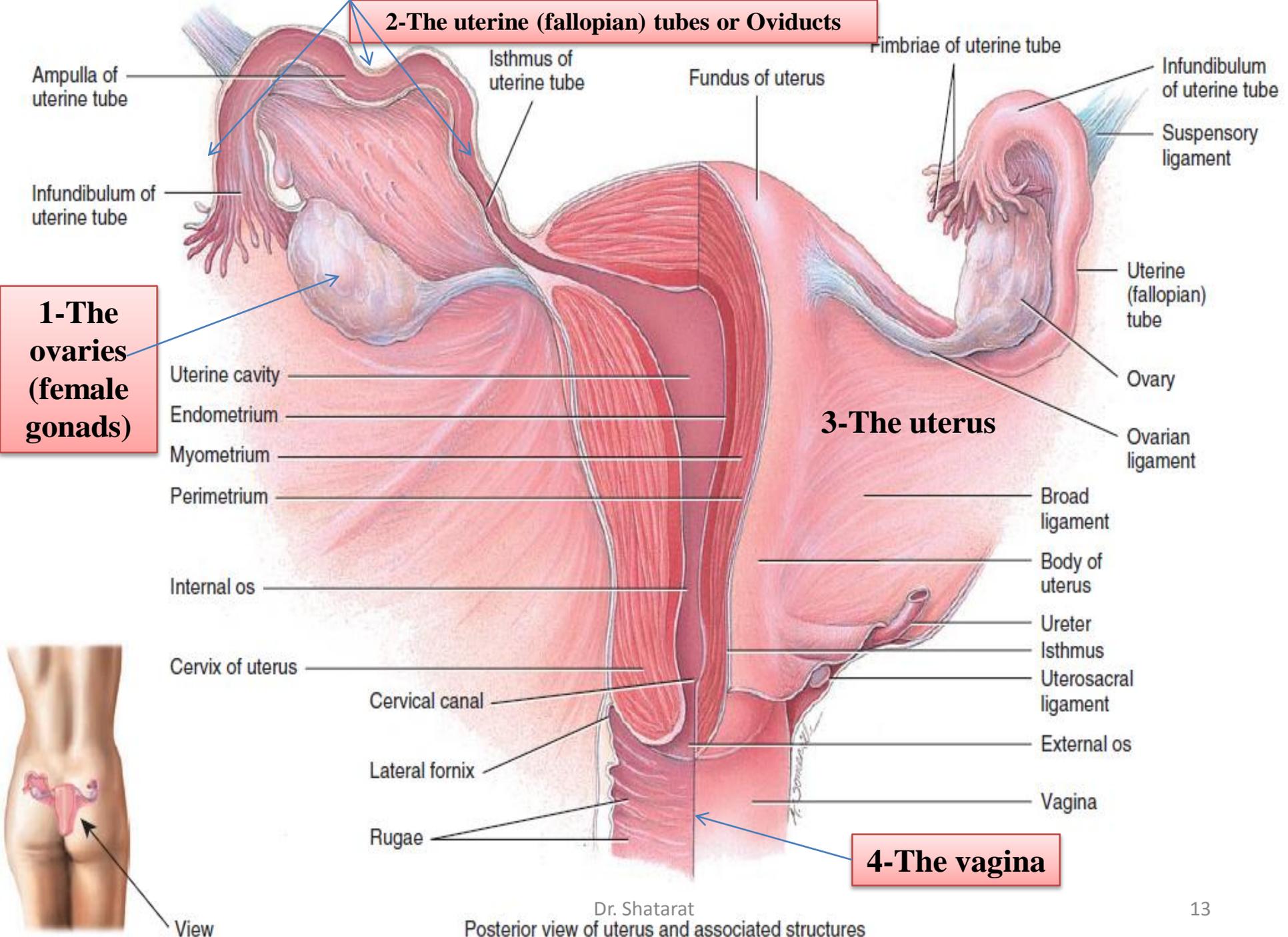
4-The vagina

5- External organs, which are collectively called the vulva, or pudendum

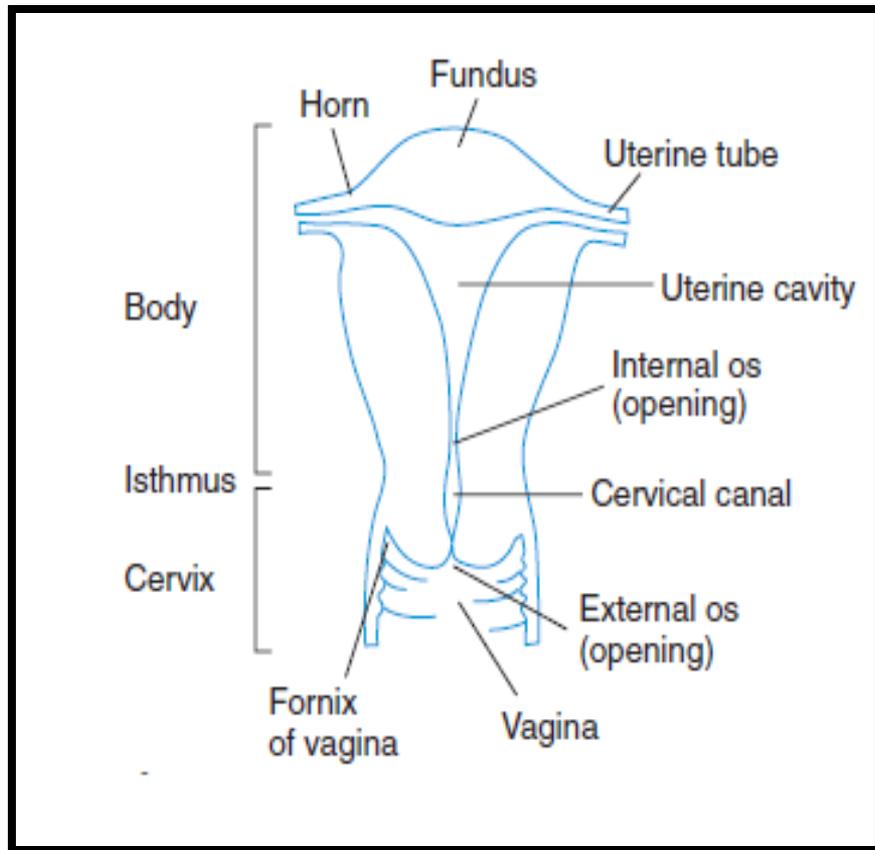
6-The mammary glands are considered part of both the integumentary system and the female reproductive system.

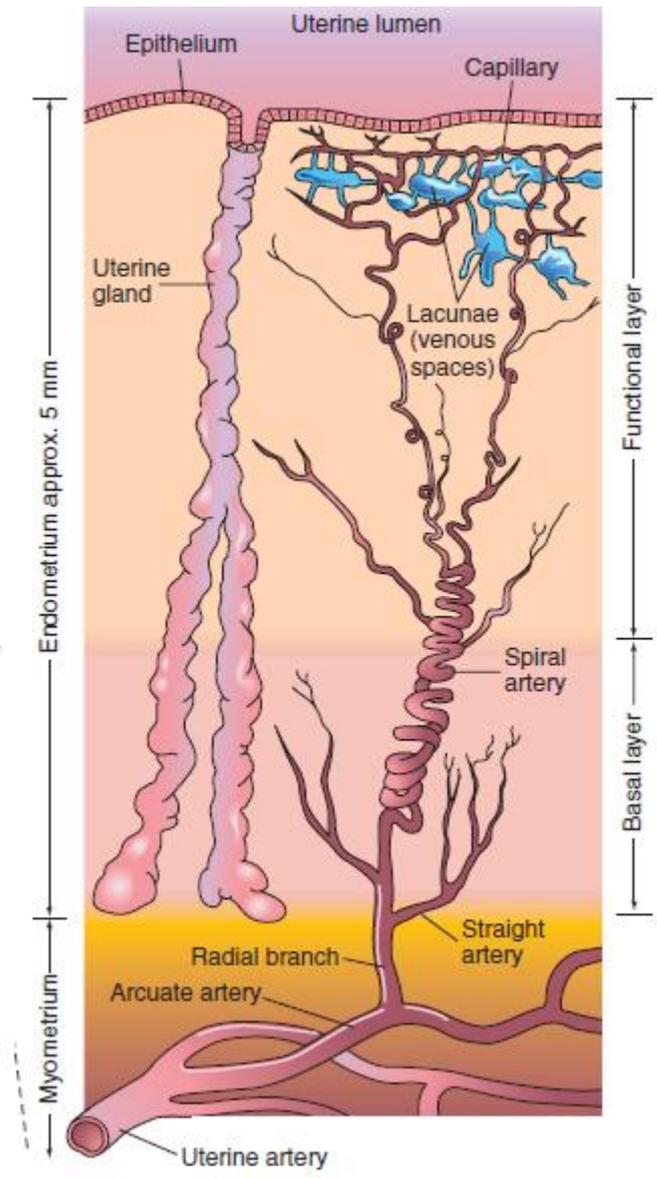
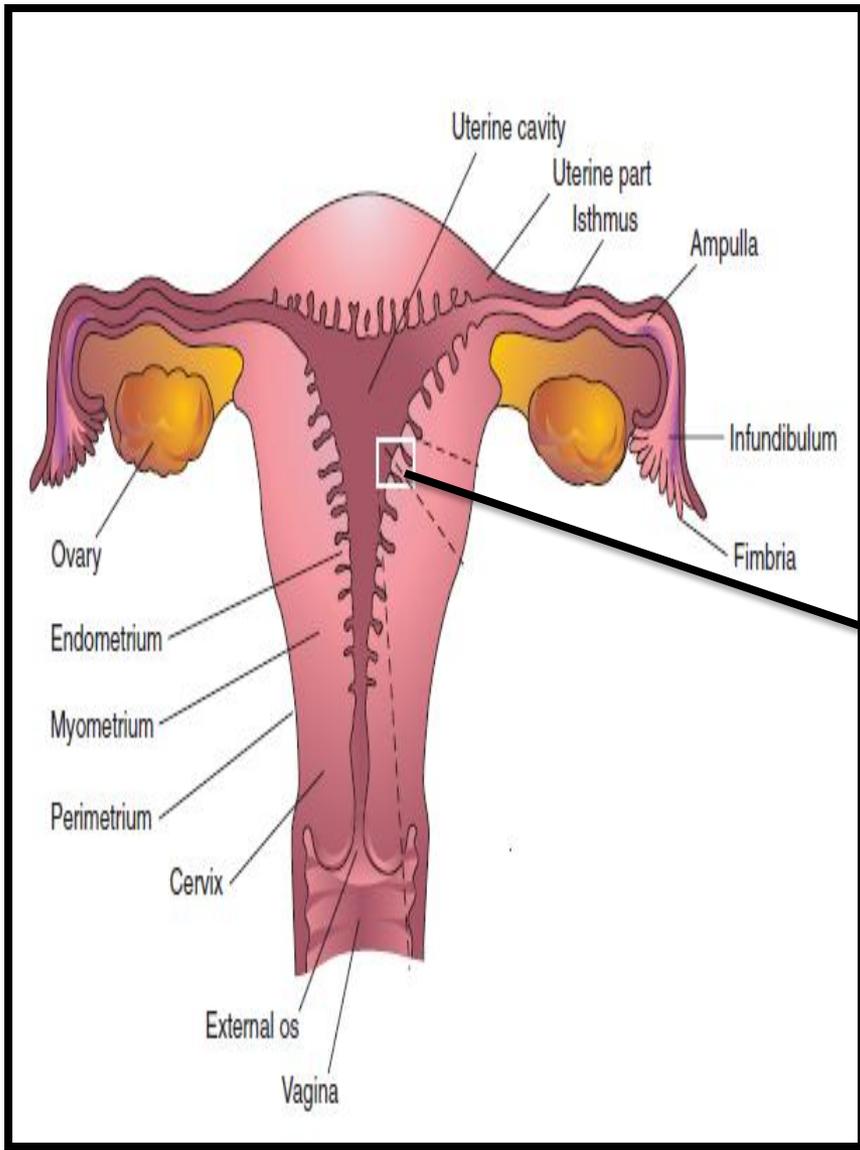


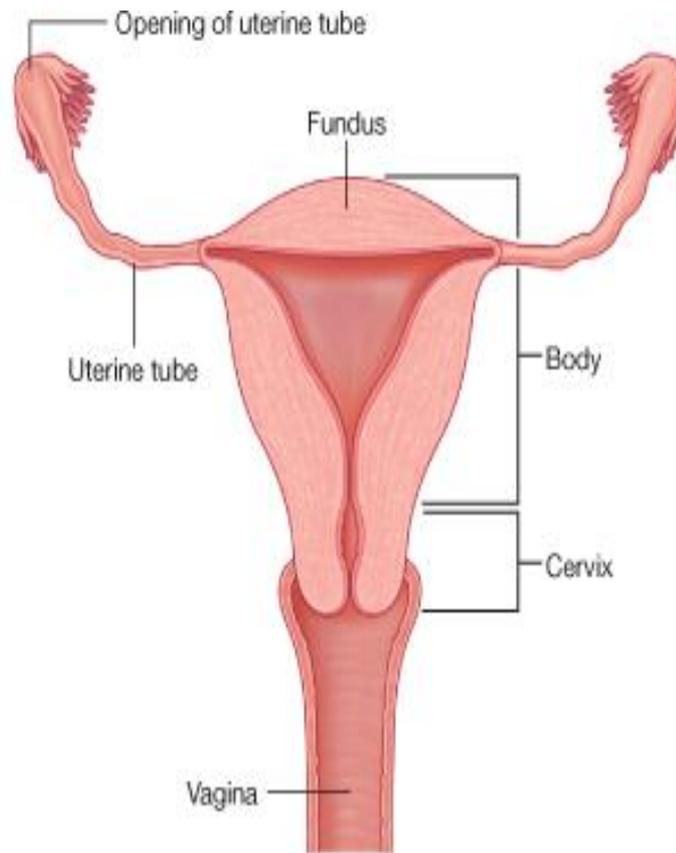




Parts of the uterus

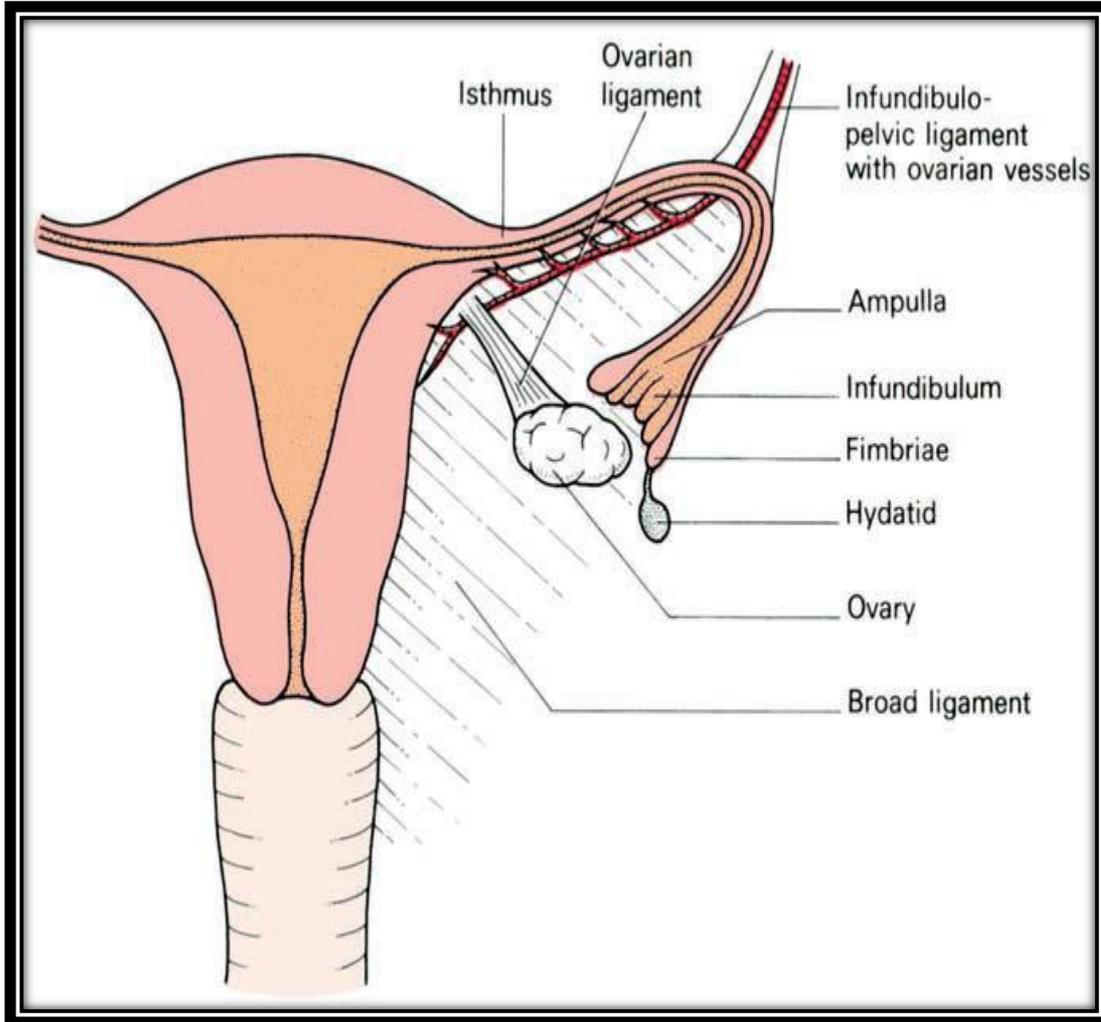






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The Fallopian tubes



- The **uterine tubes (Fallopian) or oviducts** are about **4 in (10 cm)** long
- they lie in the ***free edge of the broad ligaments***
- open into the ***cornu of the uterus***.
- They provide a route for sperm to reach an ovum and transport secondary oocytes and fertilized ova from the ovaries to the uterus.

- Each comprises four parts.
 - 1 - **The *infundibulum*** — the bugle-shaped extremity extending beyond the broad ligament and opening into the peritoneal cavity by the ***ostium***.
- Its mouth is fimbriated and overlies the ovary, to which one long fimbria actually adheres (*fimbria ovarica*).*

2-The *ampulla*—wide, thin-walled and tortuous.

3-The *isthmus*—narrow, straight and thick-walled.

4-The *interstitial part*—which pierces the uterine wall.

Structure/Histology of the oviduct

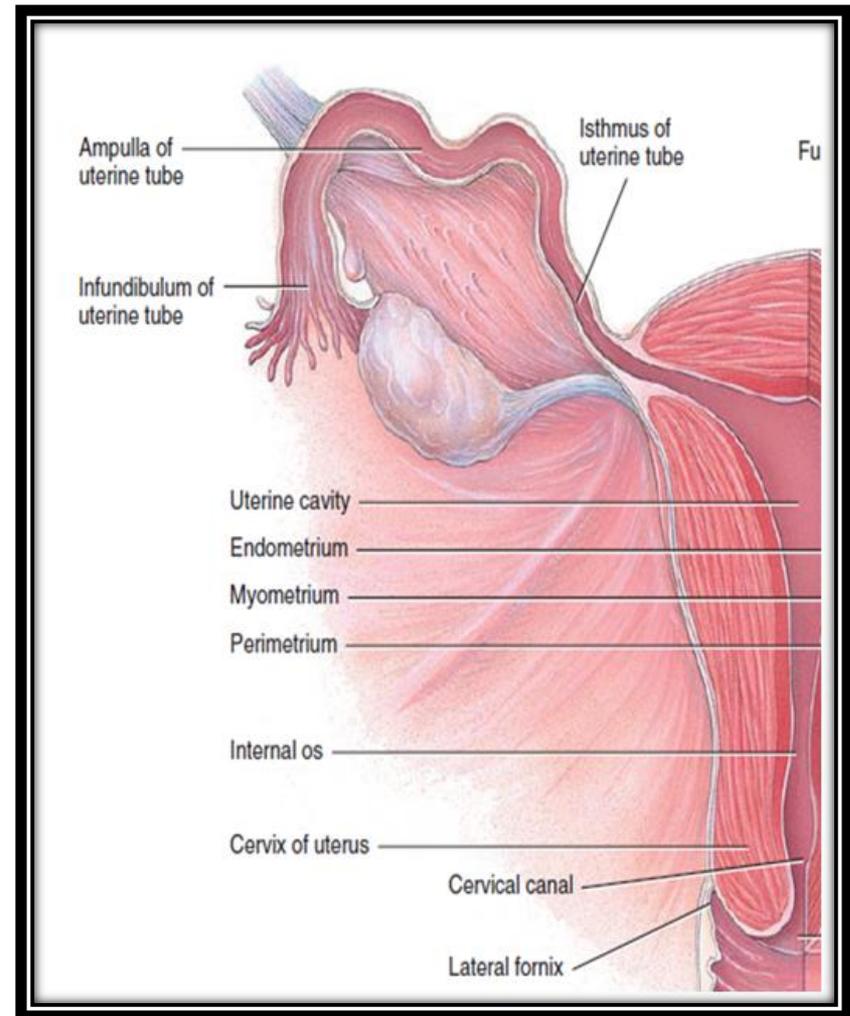
The mucosa is formed of *columnar*, mainly *ciliated cells*

The ova are propelled to the uterus along this tube, partly by peristalsis and partly by cilial action

The fertilized ovum may implant ectopically, i.e. in a site other than the endometrium of the corpus uteri.

When this occurs in the Fallopian tube it is called, according to the exact site, fimbrial, ampullary, isthmic or interstitial, of which the ampullary is the commonest and interstitial the rarest.

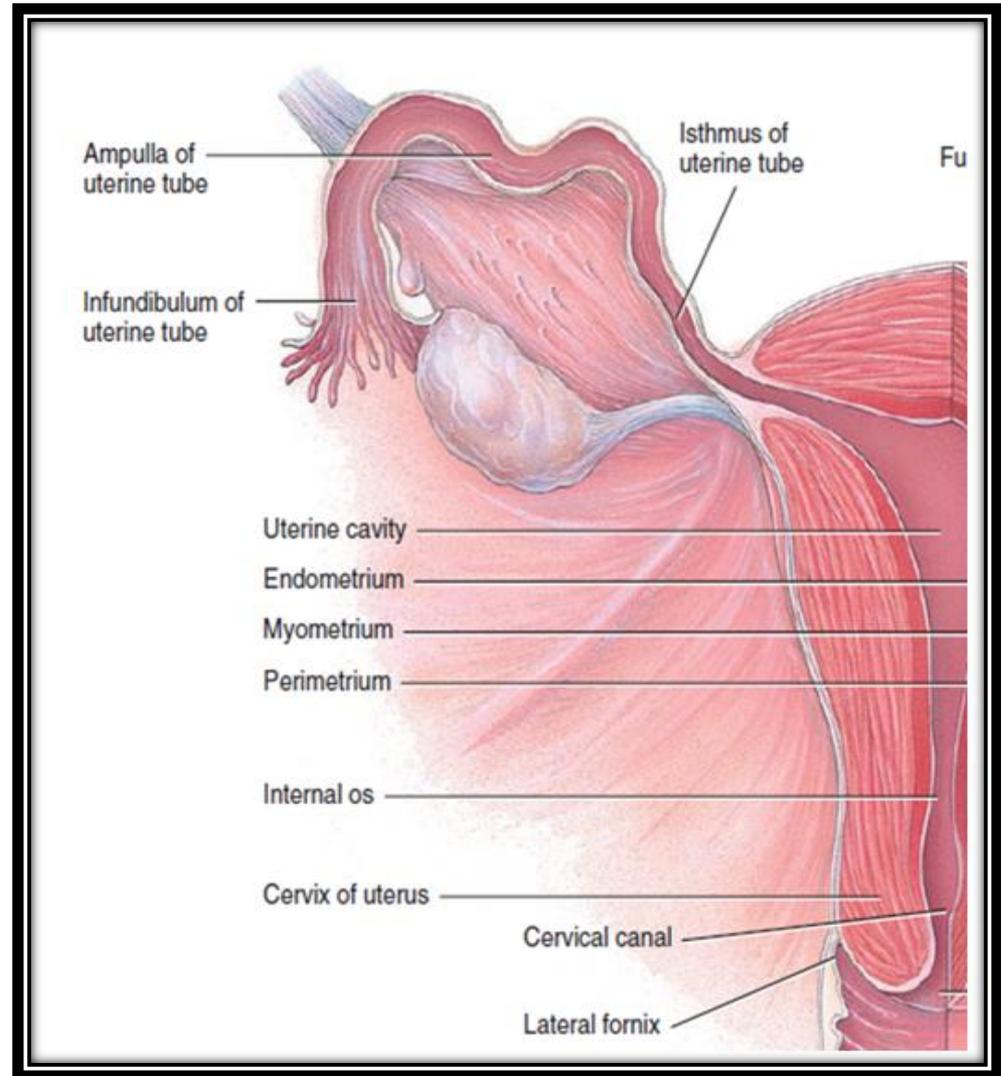
Clinical note



Ovaries

Are paired glands that resemble unshelled almonds in size and shape

The ovaries produce
(1) gametes, **secondary oocytes**
(2) hormones, including progesterone and estrogens (the female sex hormones), inhibin, and relaxin.



Histology of the Ovary

Each ovary consists of:

1-The germinal epithelium

(*germen sprout or bud*) is a layer of simple epithelium that covers the surface of the ovary.

2-The tunica albuginea

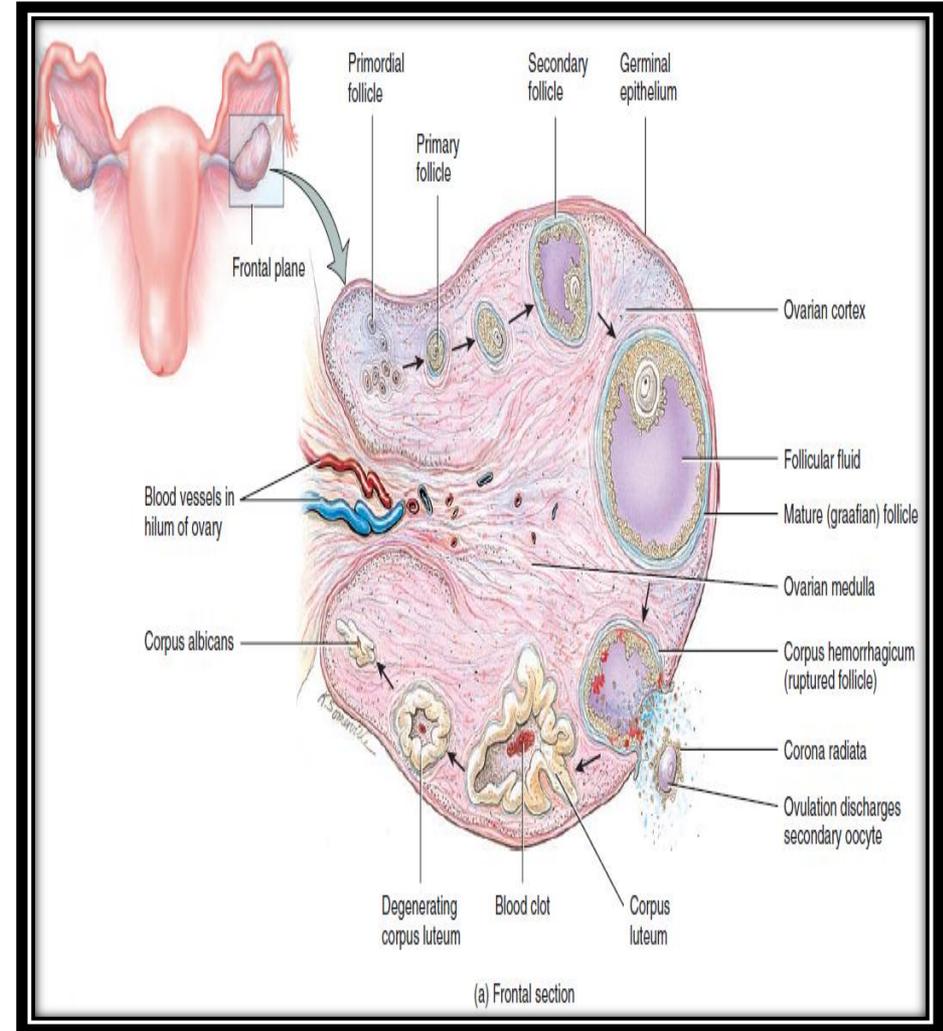
is a whitish capsule of dense irregular connective tissue located immediately deep to the germinal epithelium.

3-The ovarian cortex

is a region just deep to the tunica albuginea. It consists of ovarian follicles, (oocytes in various stages of development)

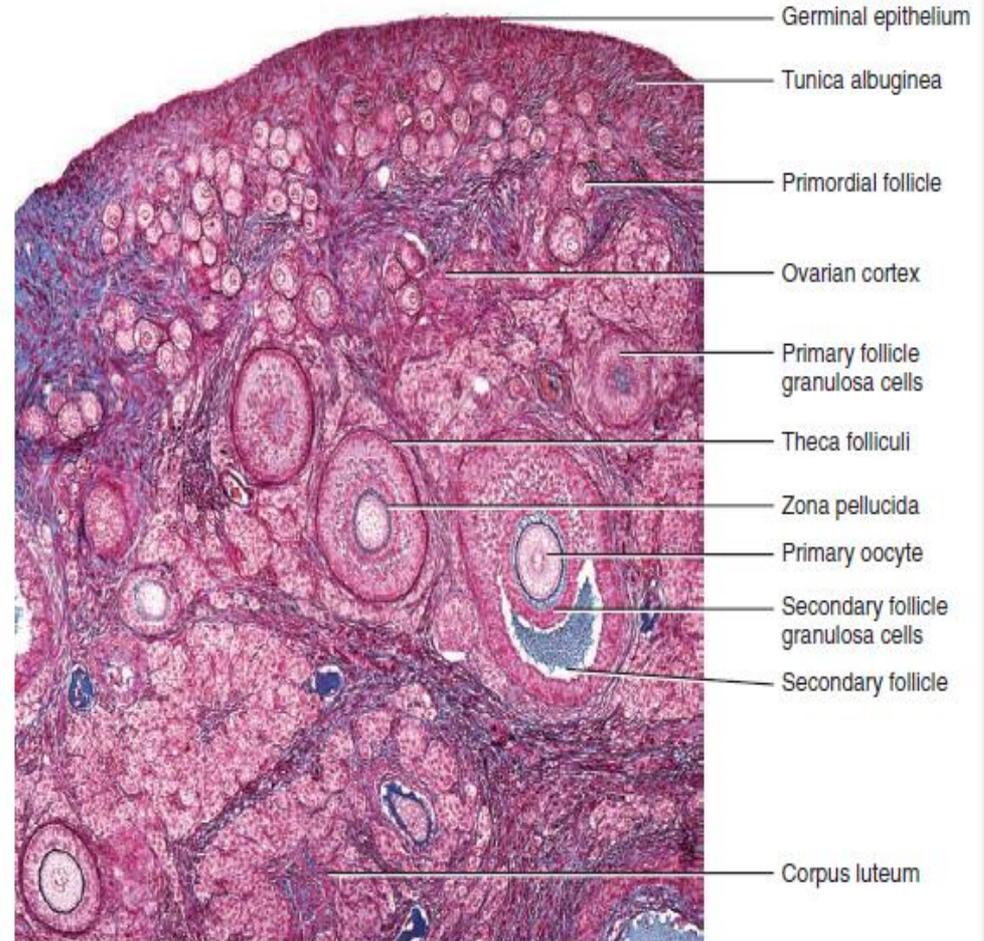
4- The ovarian medulla

is deep to the ovarian cortex. the medulla consists of more loosely arranged connective tissue and contains blood vessels, lymphatic vessels, and nerves.



ovarian cortex

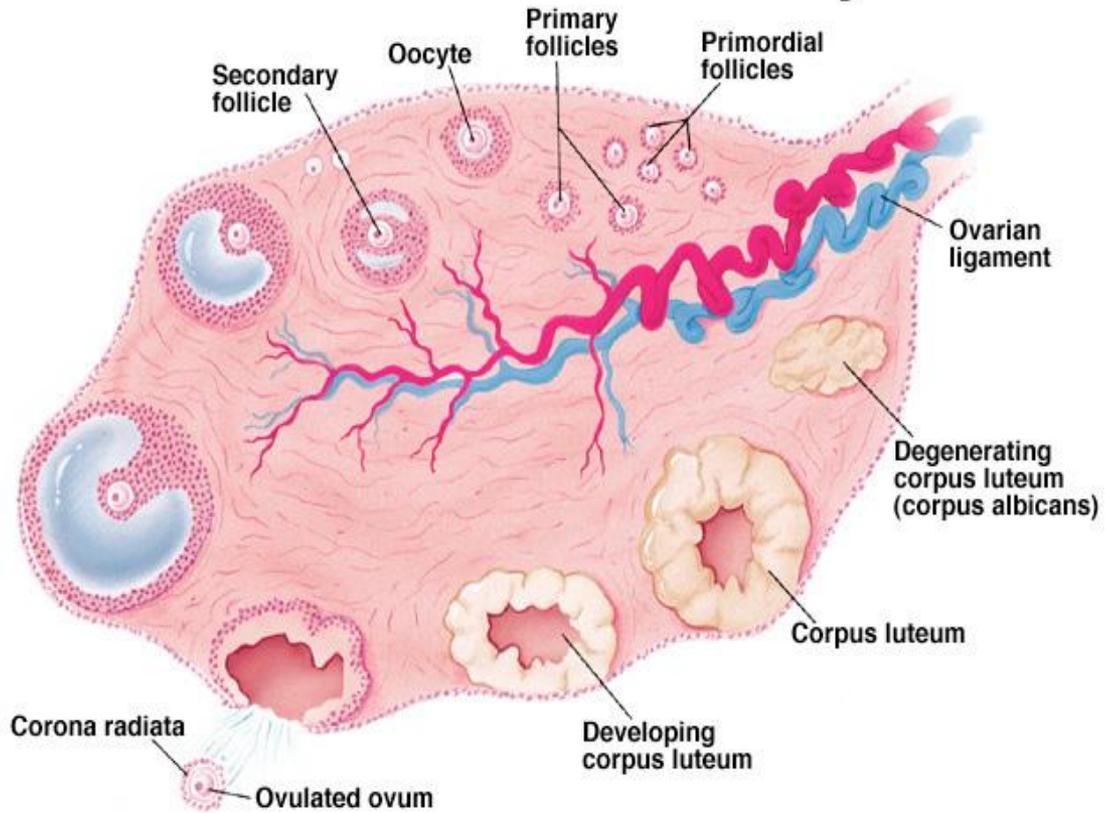
*consists of ovarian follicles,
(oocytes in various stages of development)*



LM 30x

(e) Ovarian cortex

Structure of an Ovary

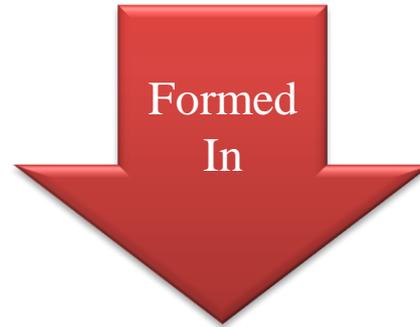


O O G E N E S I S

1-Intra-uterine

Before birth

**Gametes are derived from
Primordial germ cells**



Epiblast

During the second week



Cells move to the Wall Of Yolk Sac

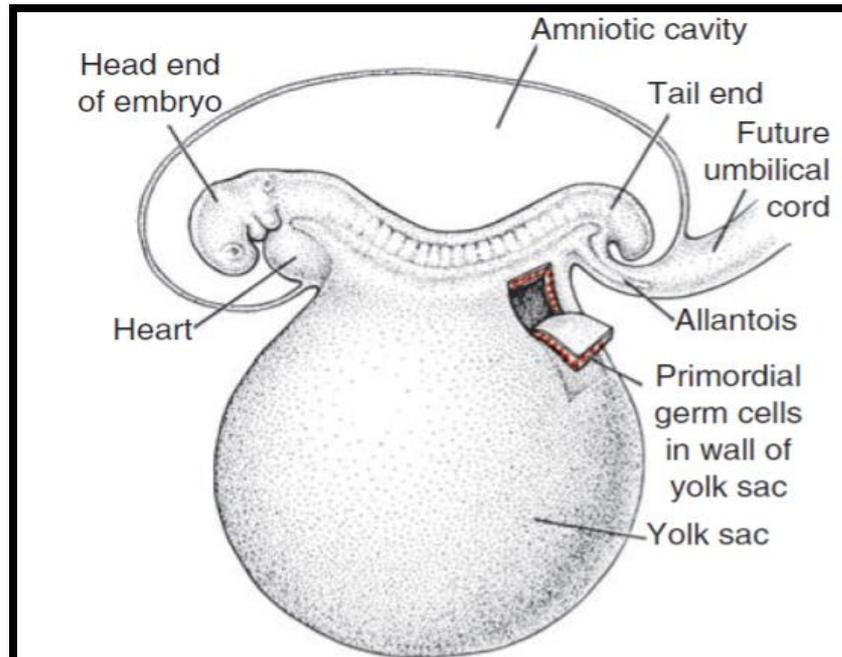


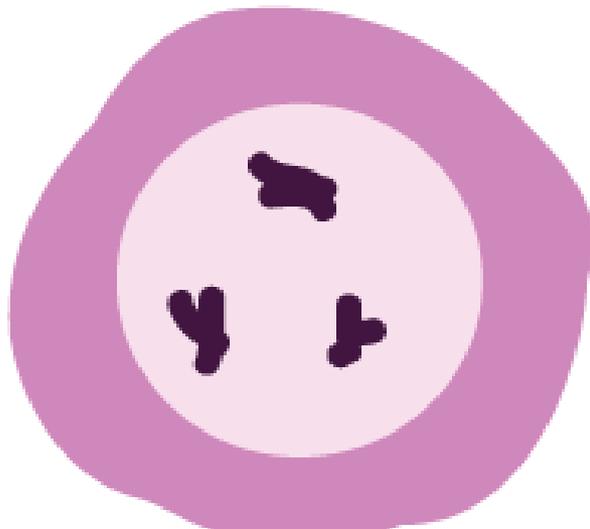
Figure 2.1 An embryo at the end of the third week, showing the position of PGCs in the wall of the yolk sac, close to the attachment of the future umbilical cord. From this location, these cells migrate to the developing gonad.

During Forth week till the end of Fifth week



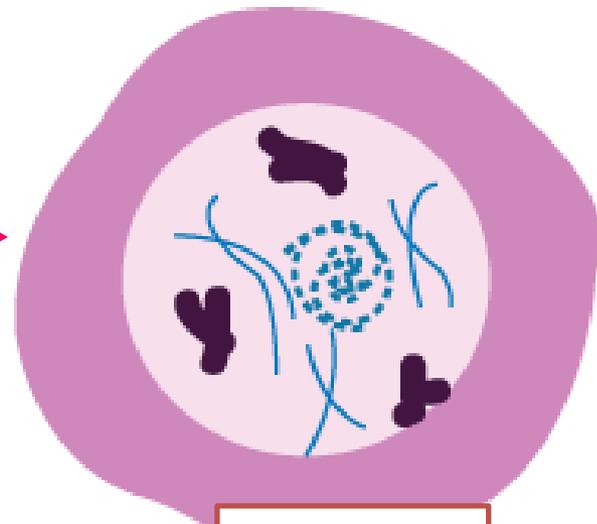
**Cells started to migrate toward
(Developing Gonads)
< Gonads of genetic females / ovaries >**

PGC's differentiate into oogonia by mitotic divisions



Primordial germ cells

mitotic divisions

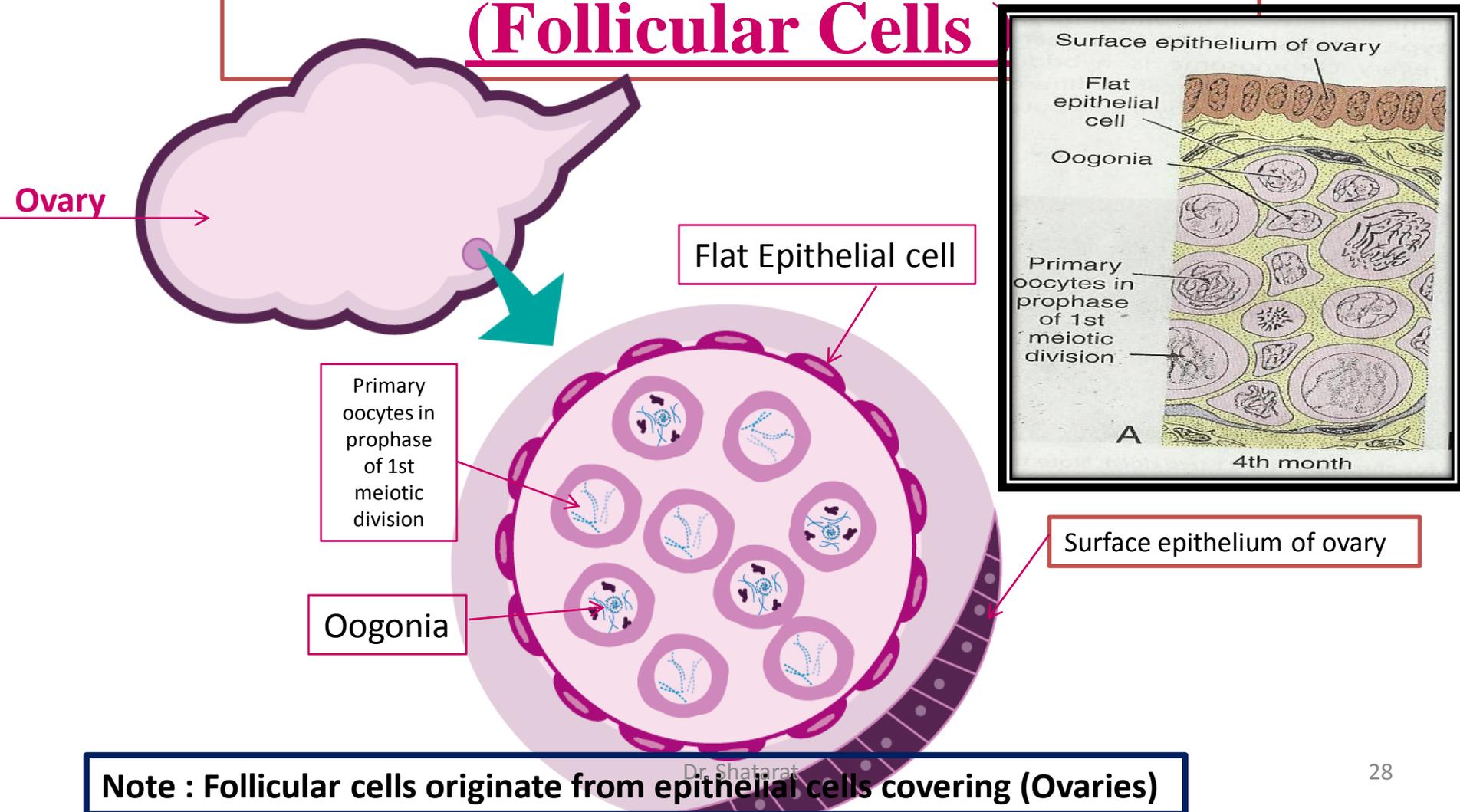


oogonia

By the End of Third Month

Oogonia arranged in clusters surrounded By
Large of **Flat epithelial cells**

(Follicular Cells



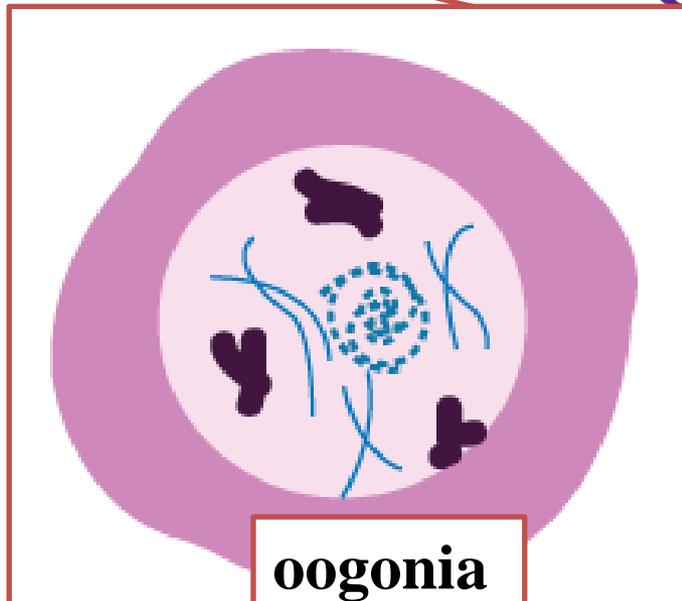
Note : Follicular cells originate from epithelial cells covering (Ovaries)

Oogonia continue to divide by
Mitosis

But some of them arrest in their cell
divisions in
(Prophase Meiosis 1)

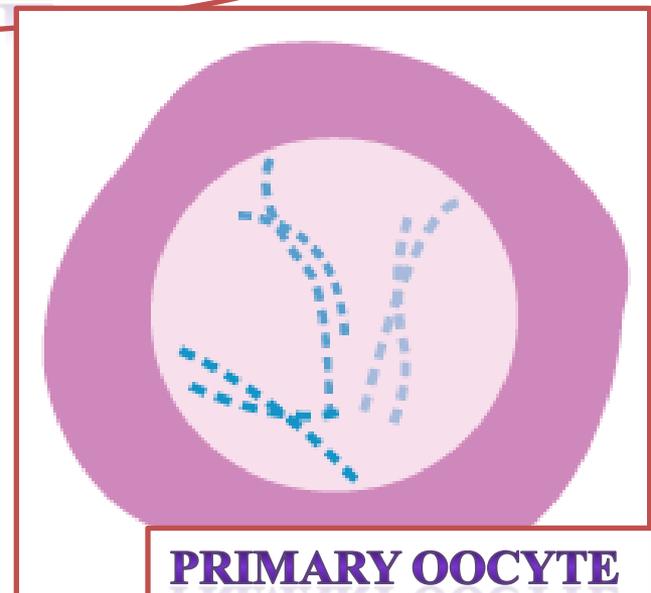
And
form

**PRIMARY
OOCTE**



mitotic divisions

Dr. Shatarat



Then In The
Next few months



Oogonia increase rapidly in
numbers

**By the end of Fifth
month**

```
graph TD; A["By the end of Fifth month"] --> B["Total numbers of germs cells in ovary reach maximum"]; B --> C("Estimated 7 Millions"); C --> D["At this time Many oogonia and primary oocyte become atretic"];
```

**Total numbers of germs cells
in ovary reach maximum**

**Estimated 7
Millions**

**At this time
Many oogonia and primary oocyte
become atretic**

By the Seventh Month

Majority of oogonia have degenerated except for few near surface

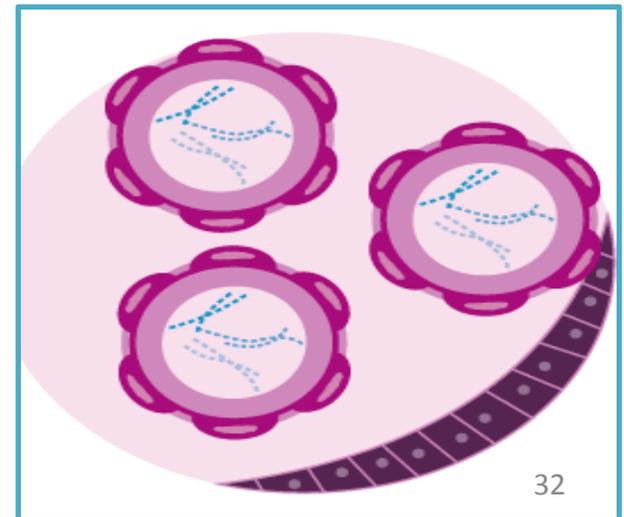
All surviving primary oocytes
WILL

Enter prophase of meiosis 1

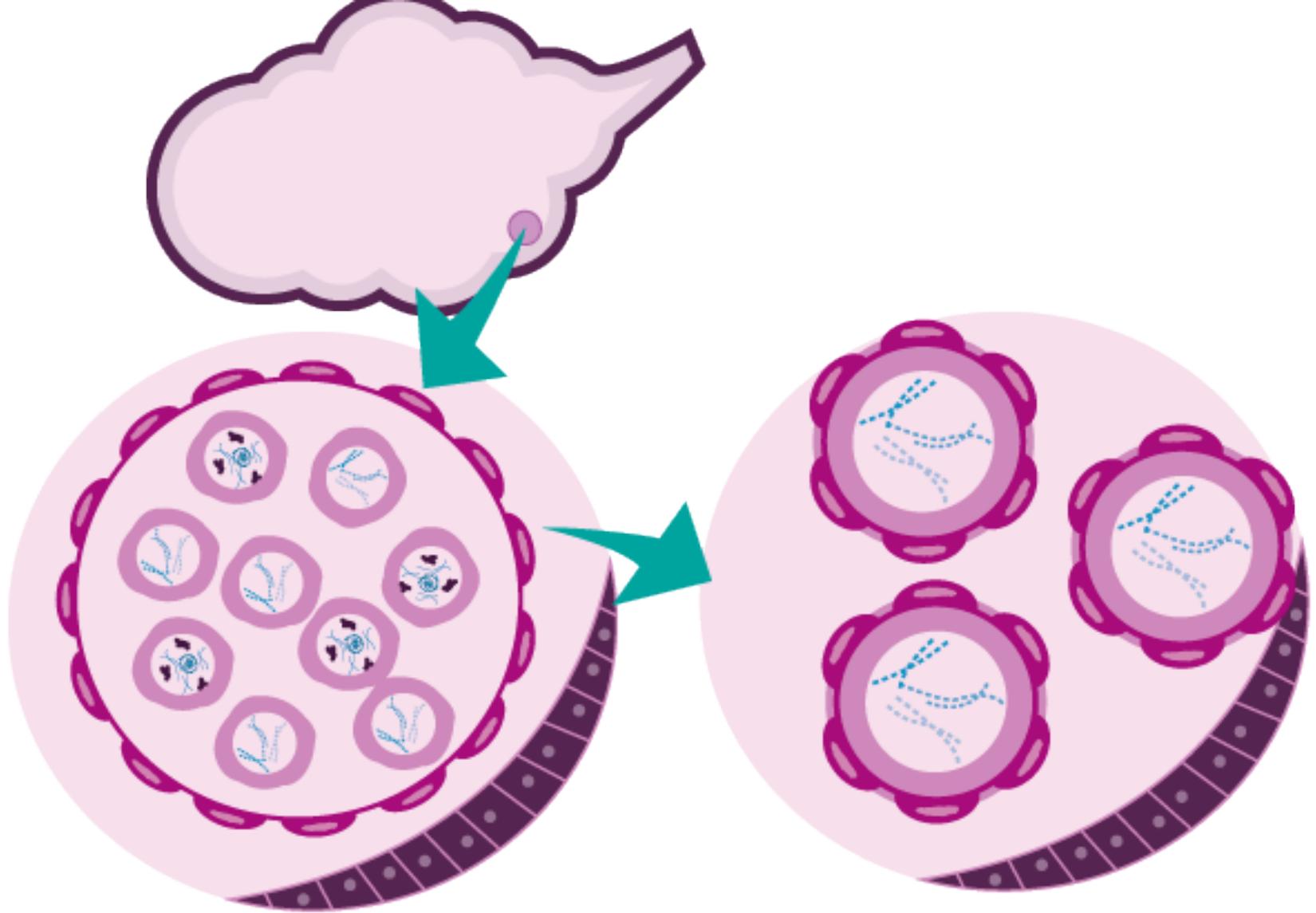
Individually surrounded by a layer of
flat cells (Follicular epithelial cells)

This structure
named
(**Primordial
Follicle**)

Dr. Shatarat



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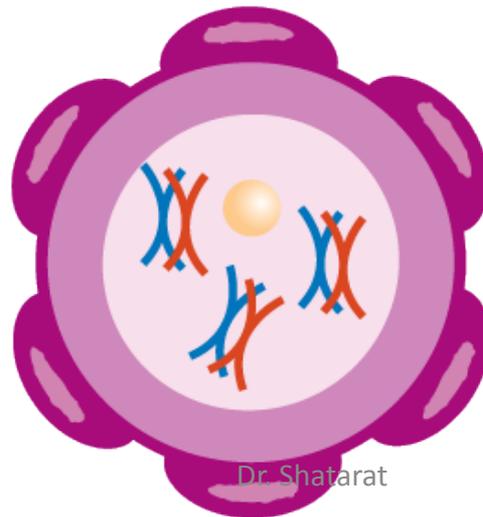


Note:
Maturation of Oocytes Continues at
Puberty

Near the time of birth

all primary oocytes have
started prophase of meiosis I

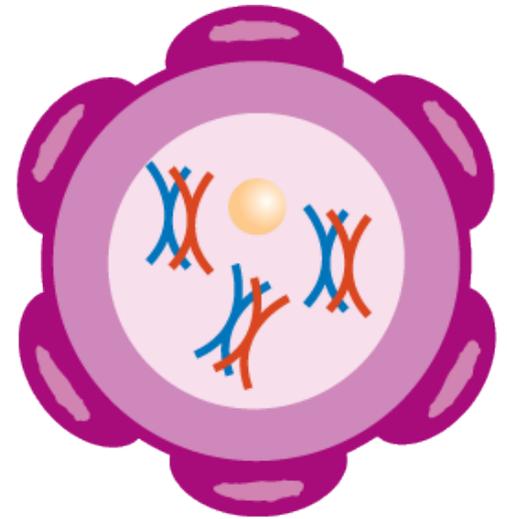
but instead of proceeding
into metaphase, they enter the
(diplotene stage)



Primary oocytes remain arrested
in prophase of meiosis I diplotene stage and
do not
finish their first meiotic division
before puberty is reached.

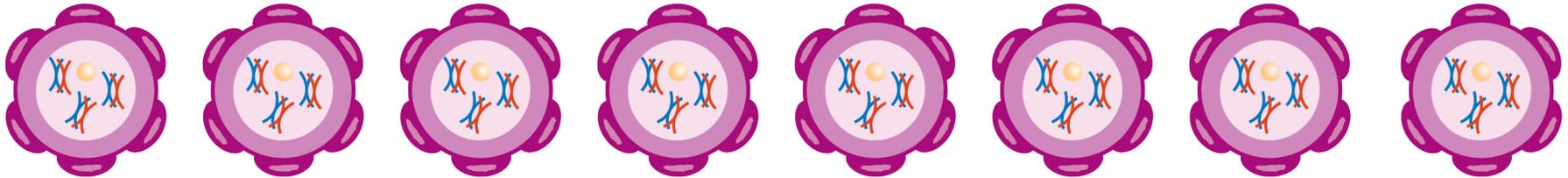
This *arrested state* is produced by
oocyte maturation inhibitor
(OMI)

a small peptide secreted by follicular cells



At BIRTH

The **total number of primary oocytes at birth** is estimated to vary from **600,000 to 800,000**



Note 1: primary oocyte and flat epithelial cells known as (primordial follicle).
Note 2: It's still "primary oocyte" rested in (diplotene stage in meiosis 1)

During childhood

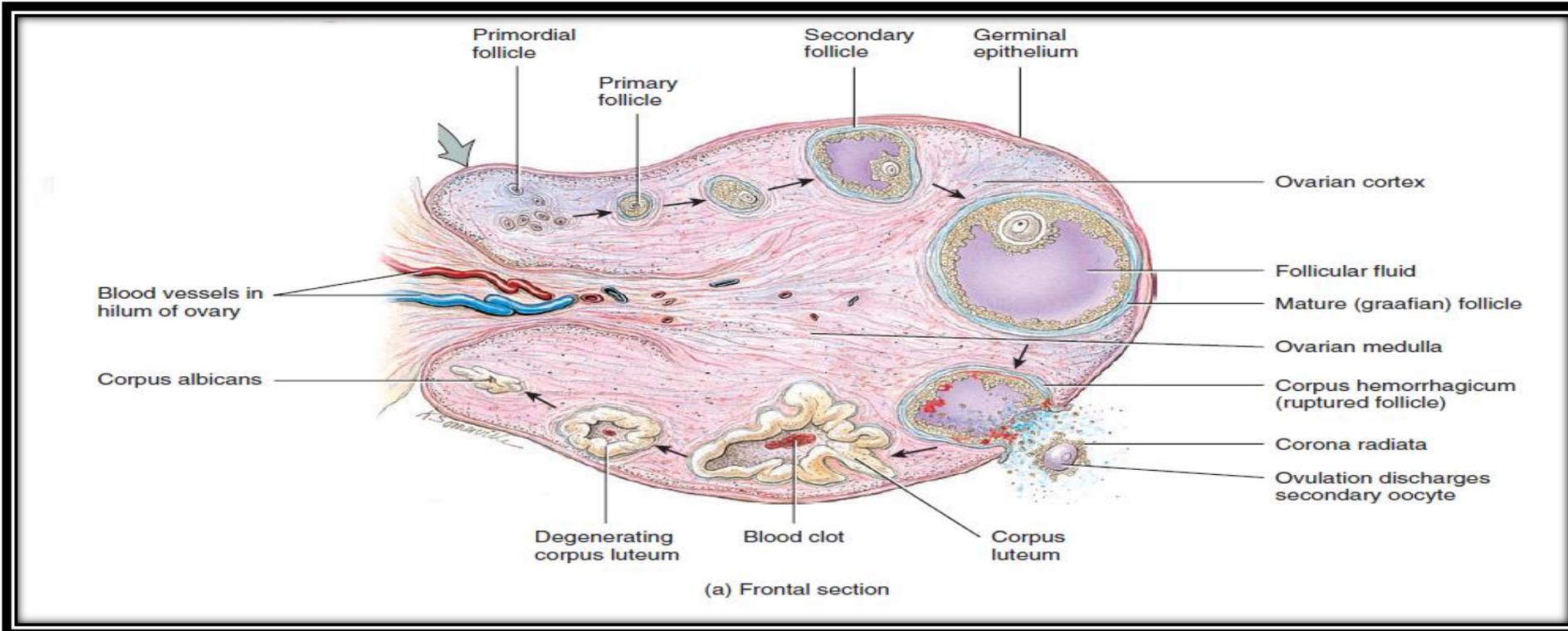
most oocytes become atretic; only approximately 40,000 are present by the beginning of puberty

Fewer than 500 will be ovulated

At Puberty

At puberty

15 to 20 follicles selected to be mature and pass through 3 stages **each month**, and **only one of these follicle reaches full maturity**



**1. Primary
(preantral)
follicle**

**2. Secondary
(antral)
follicle**

**3. preovulatory
(Graafian)
follicle**

**Primordial
follicle**

To

**Primary
follicle**

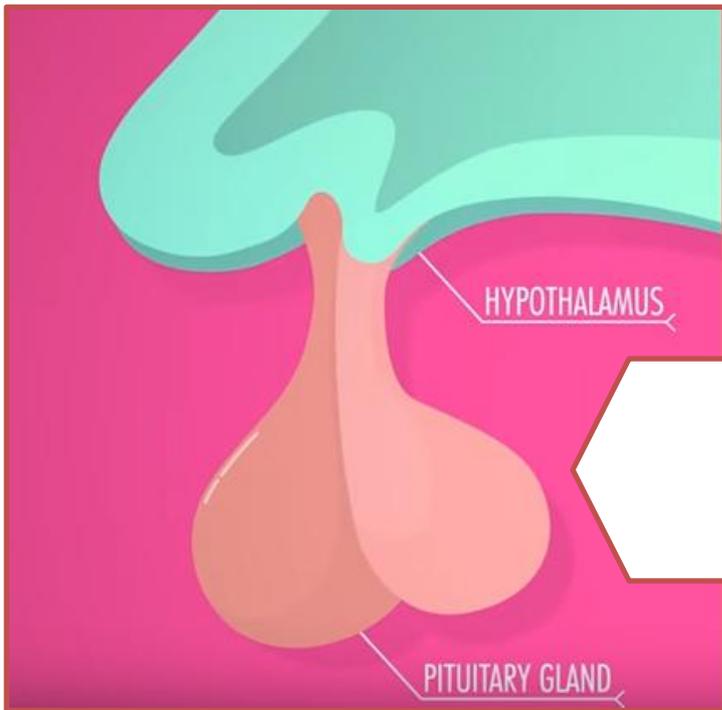
Hypothalamus

Stimulates

**Pituitary
gland**

To
secrete

FSH (Folicle stimulating hormon)



1

Primordial follicle

To

Primary follicle

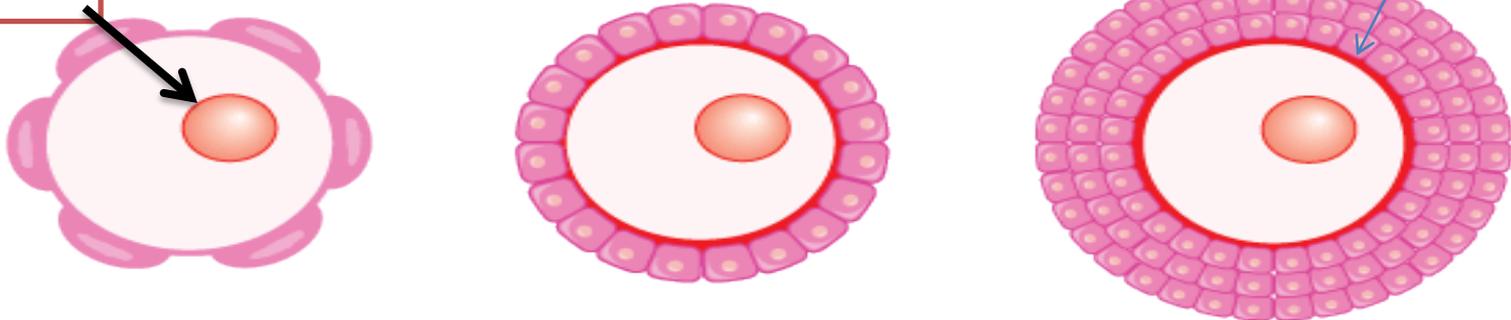
FSH

15-20 of cells to form primary oocyte but one of them reach full maturity

Stimulate follicular (granulosa) cells around oocyte.

Nucleus

Zona pellucida



Flat epithelial

To

Cuboidal epi

To

Stratified granulosa

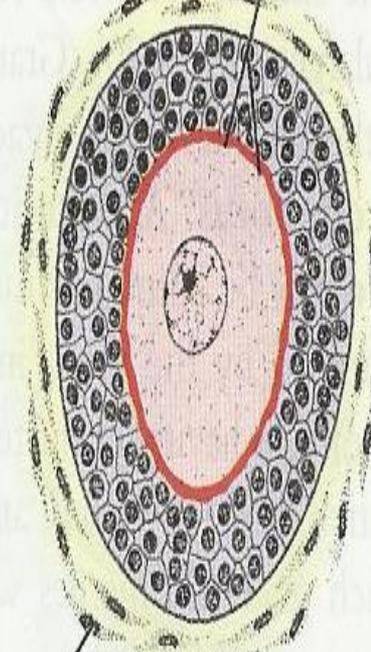
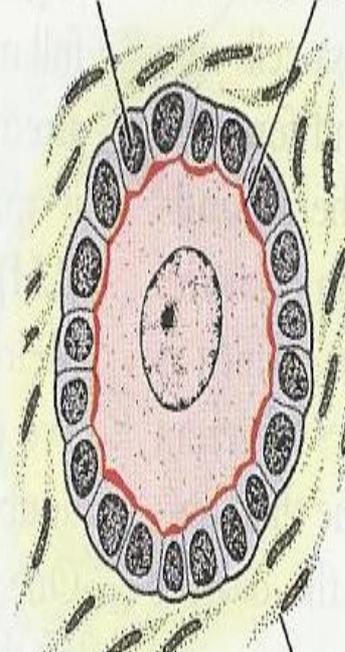
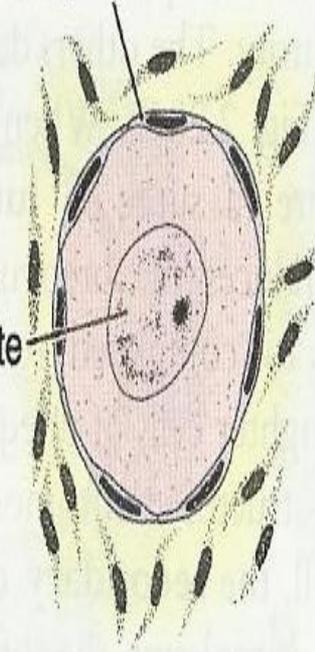
Flat epithelial
(follicular) cell

Cuboidal
follicular cell

Beginning of
zona pellucida

Zona pellucida

Nucleus of
primary oocyte

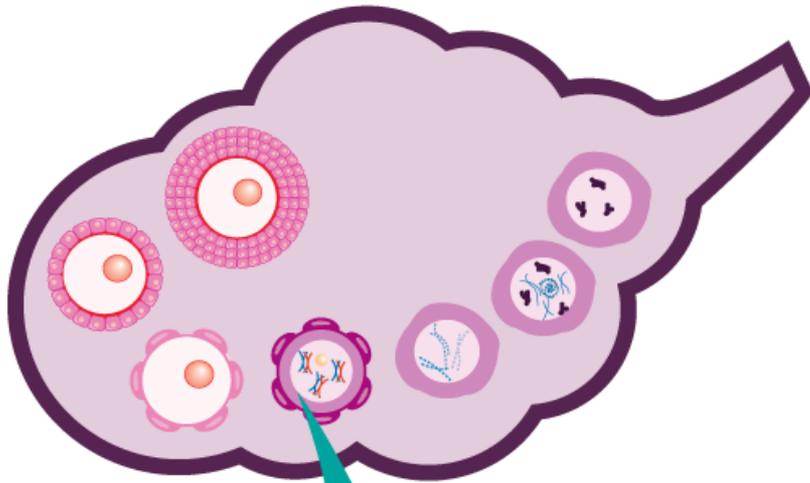


Connective tissue of ovary

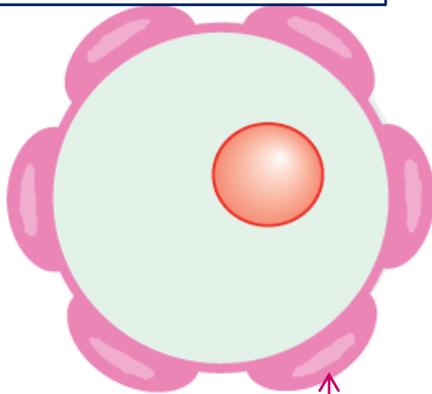
Primordial Follicle

B Growing Follicle

C Primary Follicle

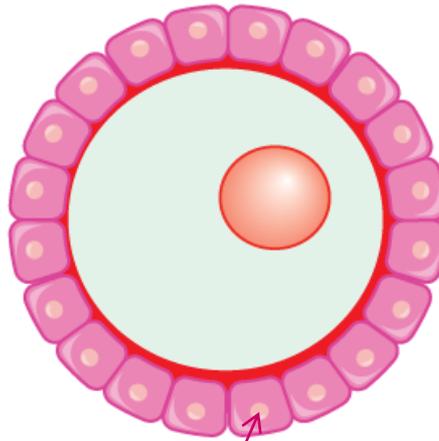


Primordial follicle



Flat epithelial

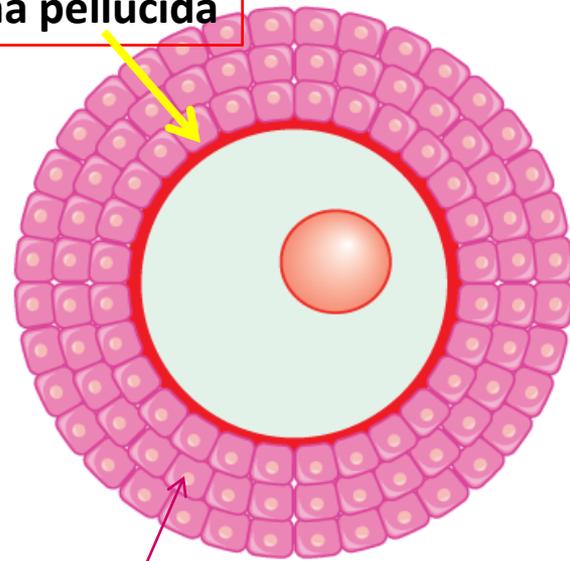
Growing follicle



Cuboidal epithelial

Primary follicle

Zona pellucida



**Stratified epi.
Of granulosa**

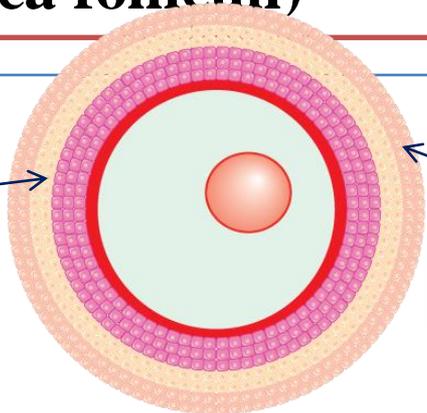
As the Primary follicle continue to grow

Primary Follicle

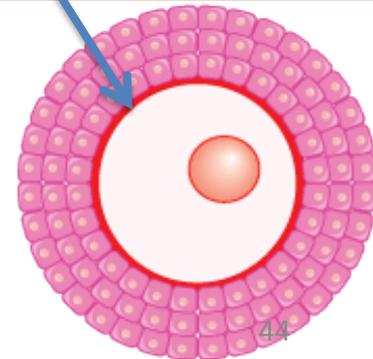
Granulosa cells rest on a basement membrane separating them from surrounding ovarian connective tissue (stromal cells) that form the (theca folliculi)

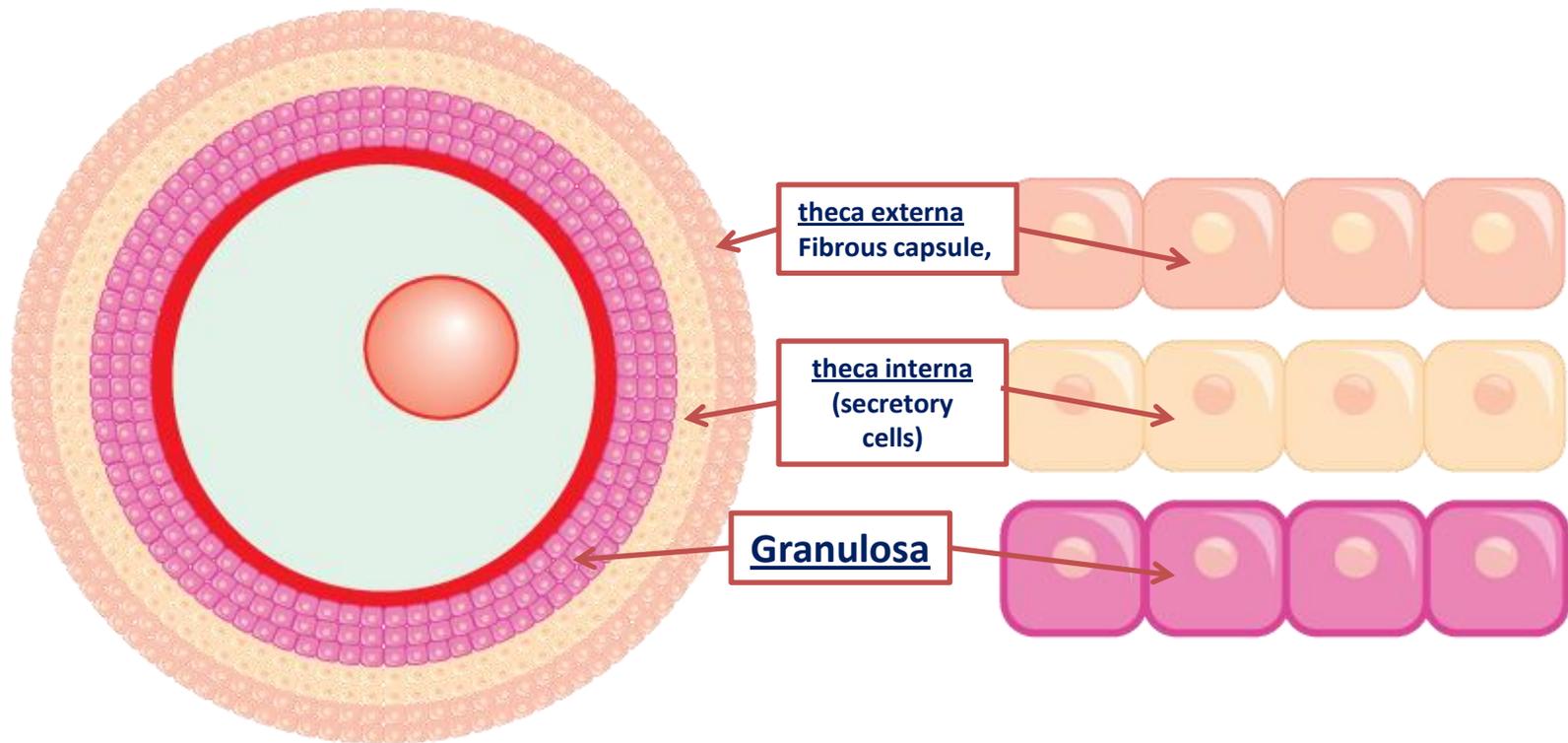
Granulosa and primary oocyte Secrete a layer of glycoproteins on the surface of the oocyte, forming the (zona pellucida)

**theca interna
(secretory cells)**



**theca externa
Fibrous capsule,**





Theca interna and granulosa
Produce :

Estrogen

Effect in uterine
endometrium

Thinning of
cervical Mucus
for sperm

Stimulate anterior
Pituitary gland to
secrete (LH)

Note: primary oocyte still in diploten stage

2

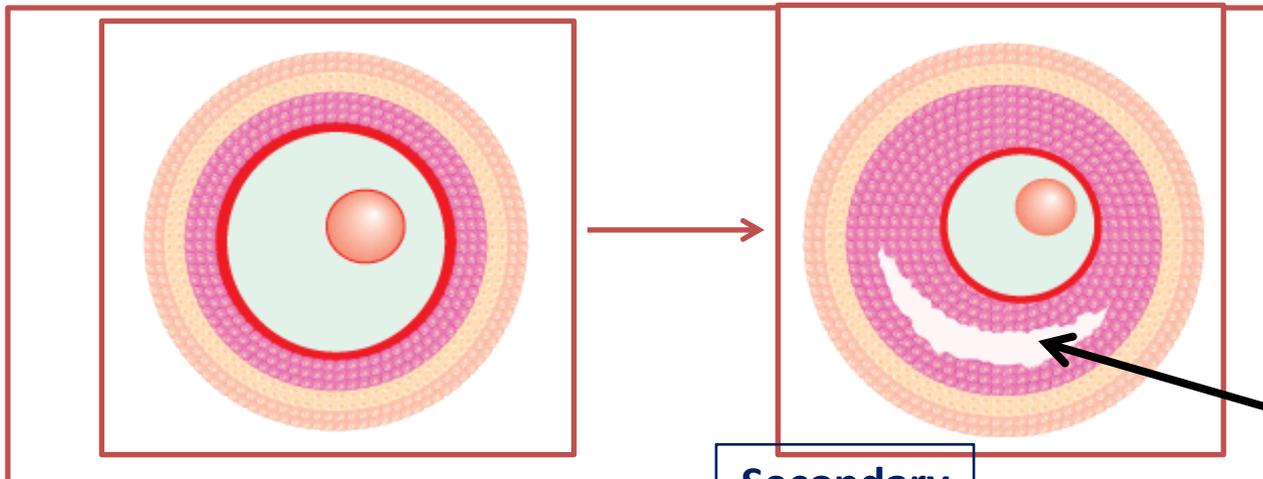
Primary
follicle

To

Secondary
Follicle

**fluid-filled spaces appear between
granulosa cells. (antrum)**

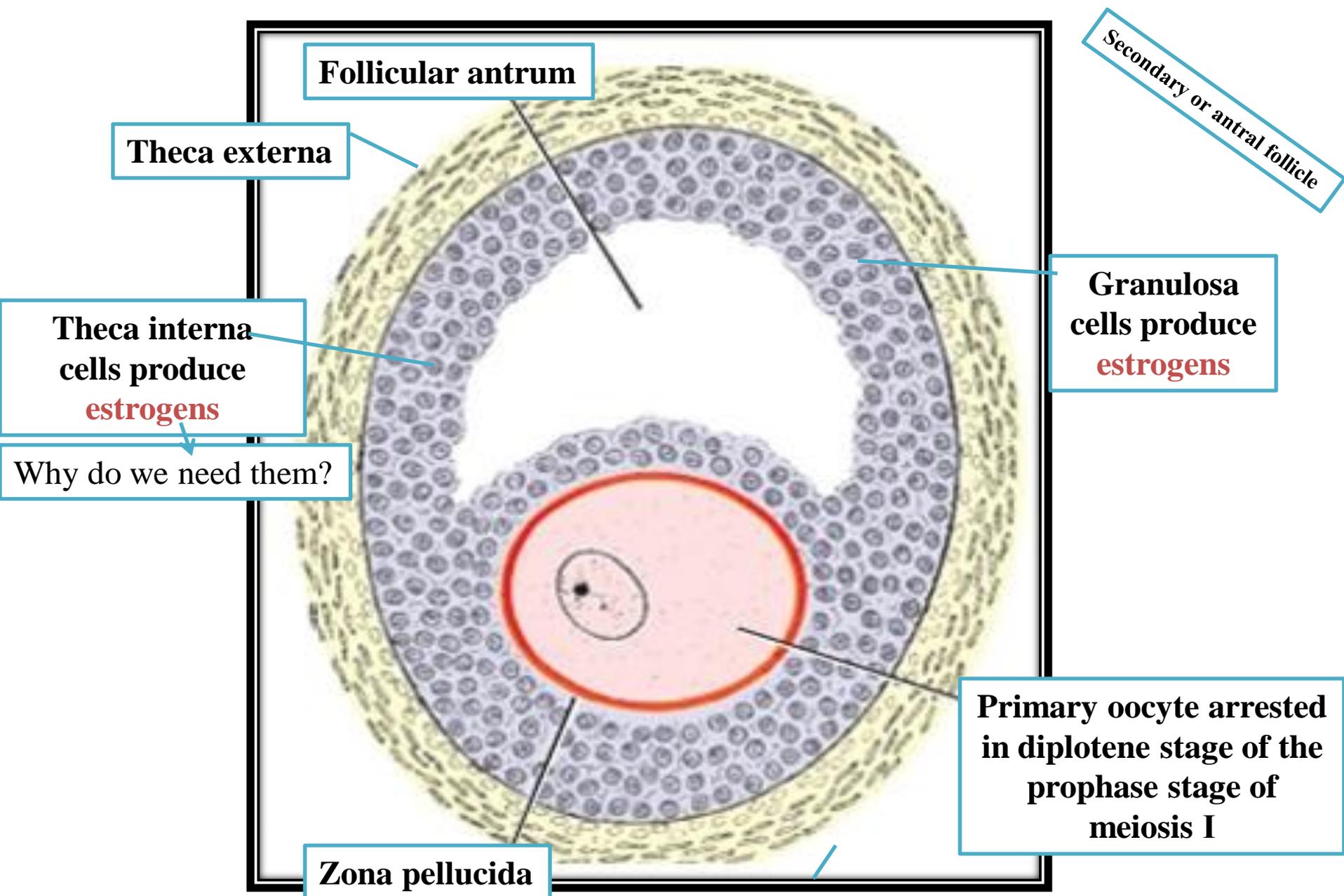
At that moment when antrum appeared follicle is termed (a vesicular or an antral or secondary follicle)



Primary
follicle

Secondary
Follicle

antrum



Note: primary oocyte still in diploten stage

When the secondary follicle is mature,
a surge in luteinizing hormone (LH)
induces promote the Preovulatory
growth phase

3

Secondary Follicle

To

Preovulatory Follicle

Three things happen

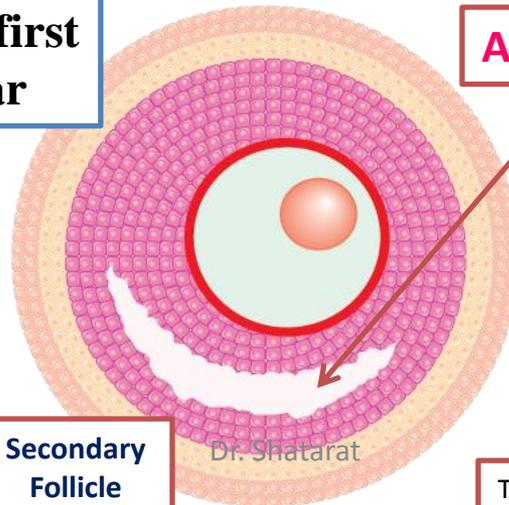
a) By influence of (LH) Meiosis I is completed, resulting in formation of two daughter cells

b) Antrum gets enlarged with time

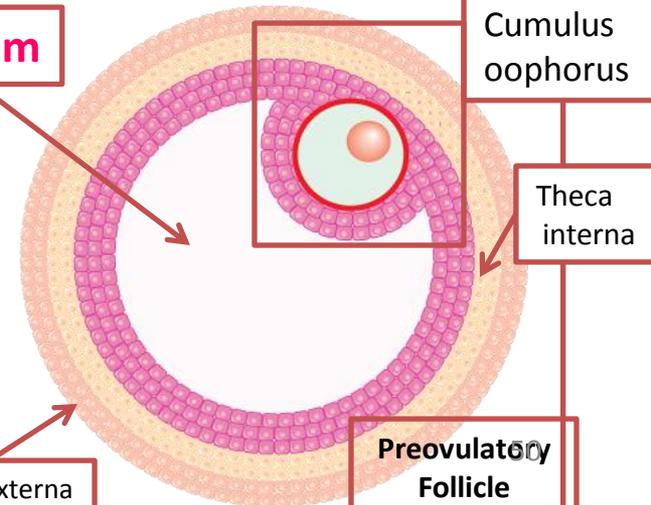
c) Granulosa cells surrounding the oocyte remain intact and form the cumulus oophorus

the secondary oocyte (enters meiosis 2 And arrested in Metaphase) 3 hours Before ovulation

the first polar



Antrum



Theca externa

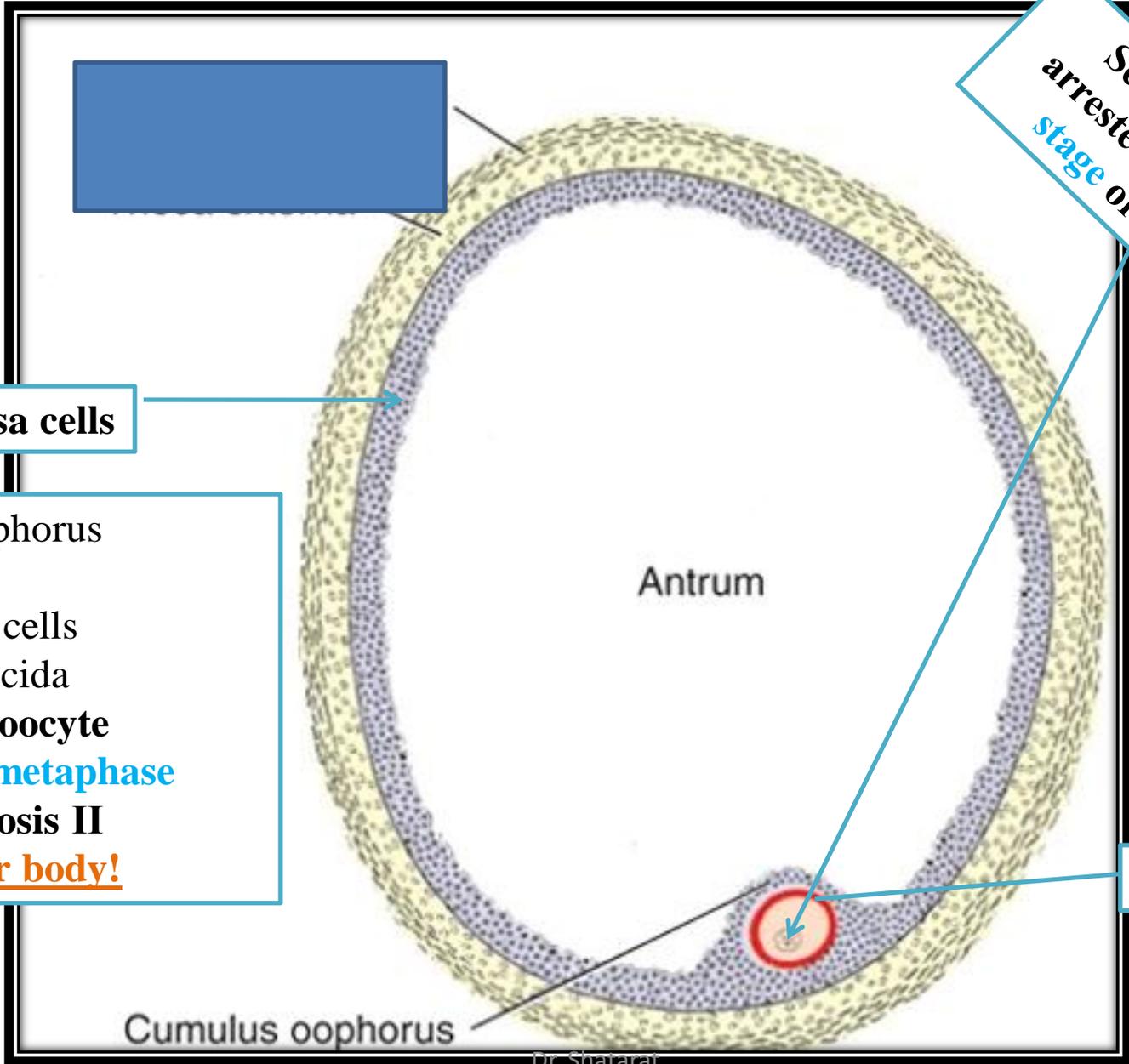
Preovulatory (Graafian follicle)

هام جدا

Secondary oocyte
arrested in *metaphase*
stage of meiosis II

Granulosa cells

Cumulus oophorus
Consists of:
1-Granulosa cells
2-Zona pellucida
3-Secondary oocyte
arrested in *metaphase*
stage of meiosis II
4-First polar body!



Zona pellucida

Cumulus oophorus

Antrum

**Preovulatory
Follicle**

To

Ovulation

(LH) increase

**The surface of
ovary bulges
locally**

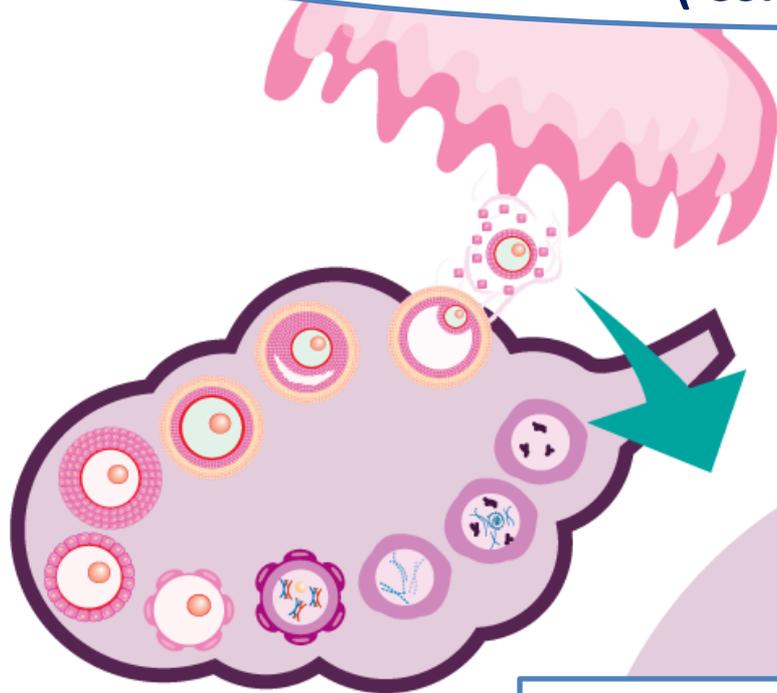
**Digestion of collagen
around follicle**

**Local muscular
contraction
In ovarian wall**



**All this will help in extrude the oocyte with
surrounding granulosa cells that form
(cumulus oophours)
BREAK FREE (ovulation) and float out of the
ovary.**

Some of (cumulus oophorus) rearranged them selves around zona pellucida to form (Corona Radiata)



Granulosa cells

Oocyte in 2nd meiotic division

Cumulus oophorus cells

OVULATION

After
Ovulation

To

Fertilization

Secondary oocyte and
Corona radiata

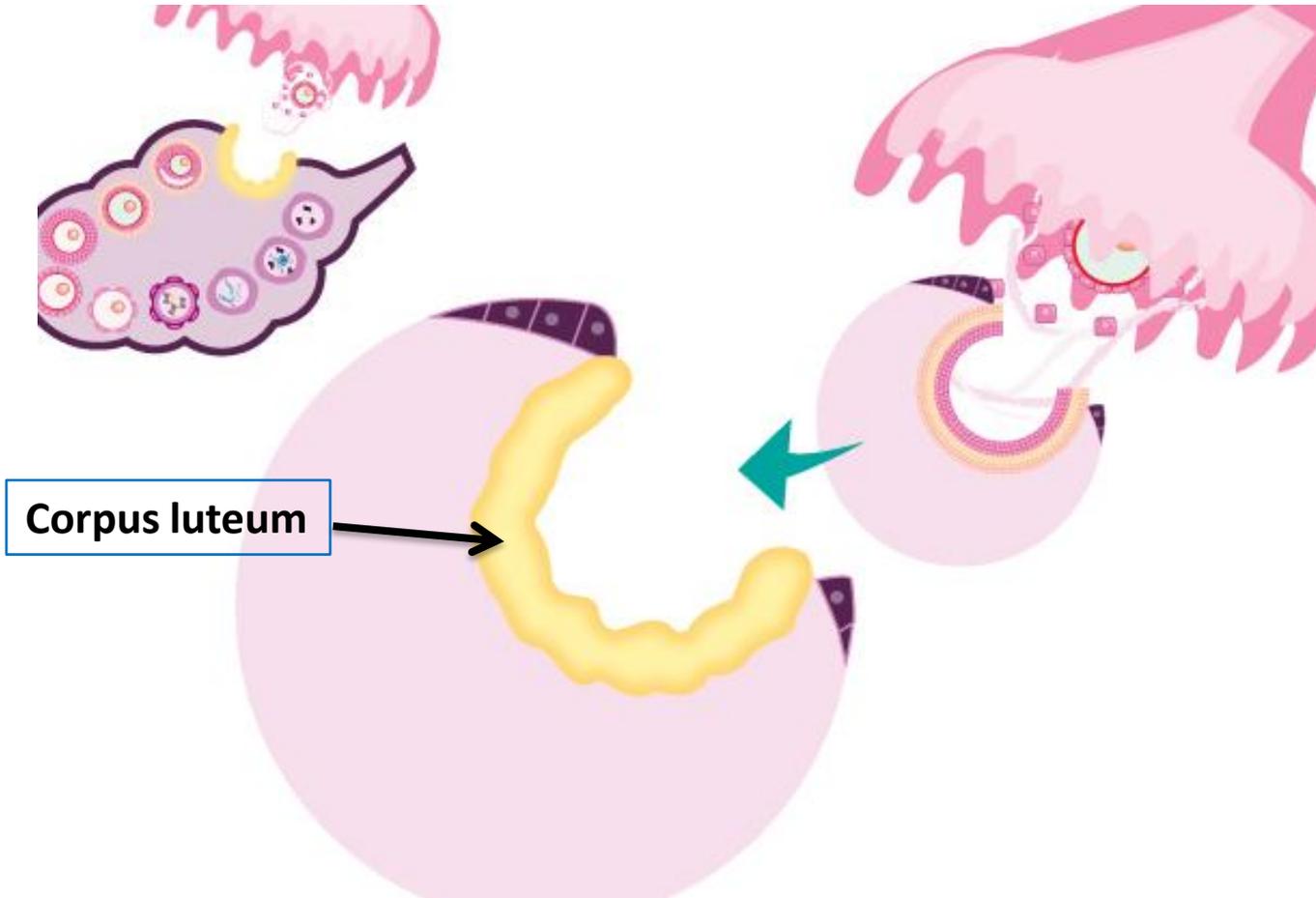
**carried into the tube by these sweeping movements
of the fimbriae and by motion of cilia on the
epithelial lining**

CORPUS LUTEUM

After ovulation, granulosa cells remaining in the wall of the ruptured follicle, together with cells from the theca interna, are vascularized by surrounding vessels. Under the influence of LH, these cells develop a yellowish pigment and change into lutein cells, which form the corpus luteum and secrete estrogens and progesterone

Progesterone, together with some **estrogen**, causes the uterine mucosa to enter the progestational or secretory stage in preparation for implantation of the embryo.





Corpus luteum

Fertilization

oocyte :

IF No sperm

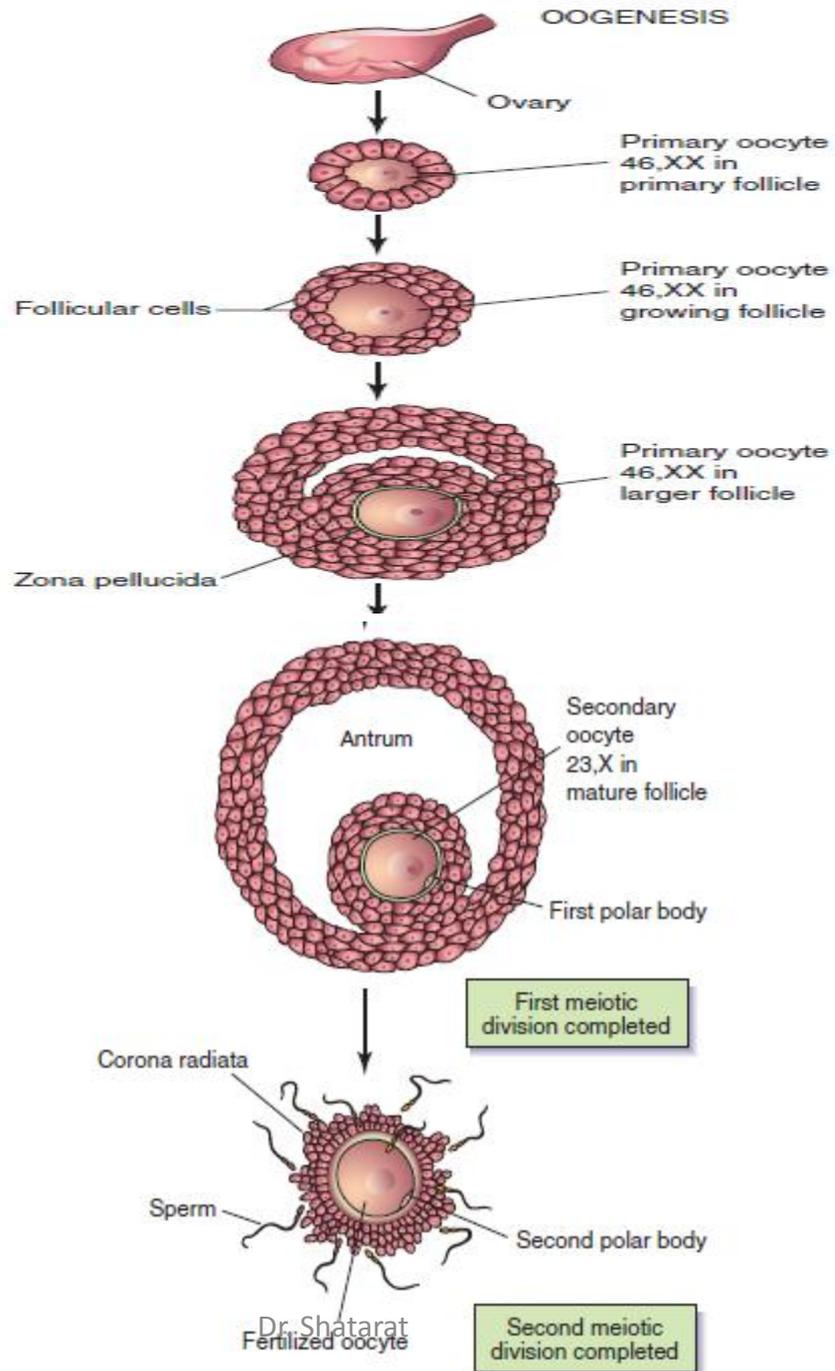
IF Sperm in tube

**oocyte is
NOT
fertilized;**

**the cell
degenerates
approximatel
y 24
hours after
ovulation.**

**oocyte is
fertilized;**

**Meiosis
II is completed in
the oocyte,
And sperm will
complete the
work**



OOGENESIS

- Primordial germ cells arrive in the indifferent gonad at week 4 and differentiate into oogonia.
- Oogonia enter meiosis I to form **primary oocytes**. All primary oocytes are formed by **month 5 of fetal life** and are **arrested the first time in prophase (diplotene) of meiosis I** and remain arrested until puberty.
- Primary oocyte arrested in meiosis I are present at birth.
- When a girl reaches puberty, during each monthly cycle a primary oocyte becomes unarrested and completes meiosis I to form a secondary oocyte and polar body.
- The secondary oocyte becomes **arrested the second time in metaphase of meiosis II** and is ovulated.
- At fertilization within the uterine tube, the secondary oocyte completes meiosis II to form a **mature oocyte** and **polar body**.

Abnormal Gametes

- In humans, **one ovarian follicle** occasionally contains two or three clearly distinguishable primary oocytes. *Although* these oocytes may give rise to twins or triplets, they usually degenerate before reaching maturity.
- In rare cases, one primary oocyte contains two or even three nuclei. *Such binucleated or trinucleated oocytes die before reaching maturity.*

