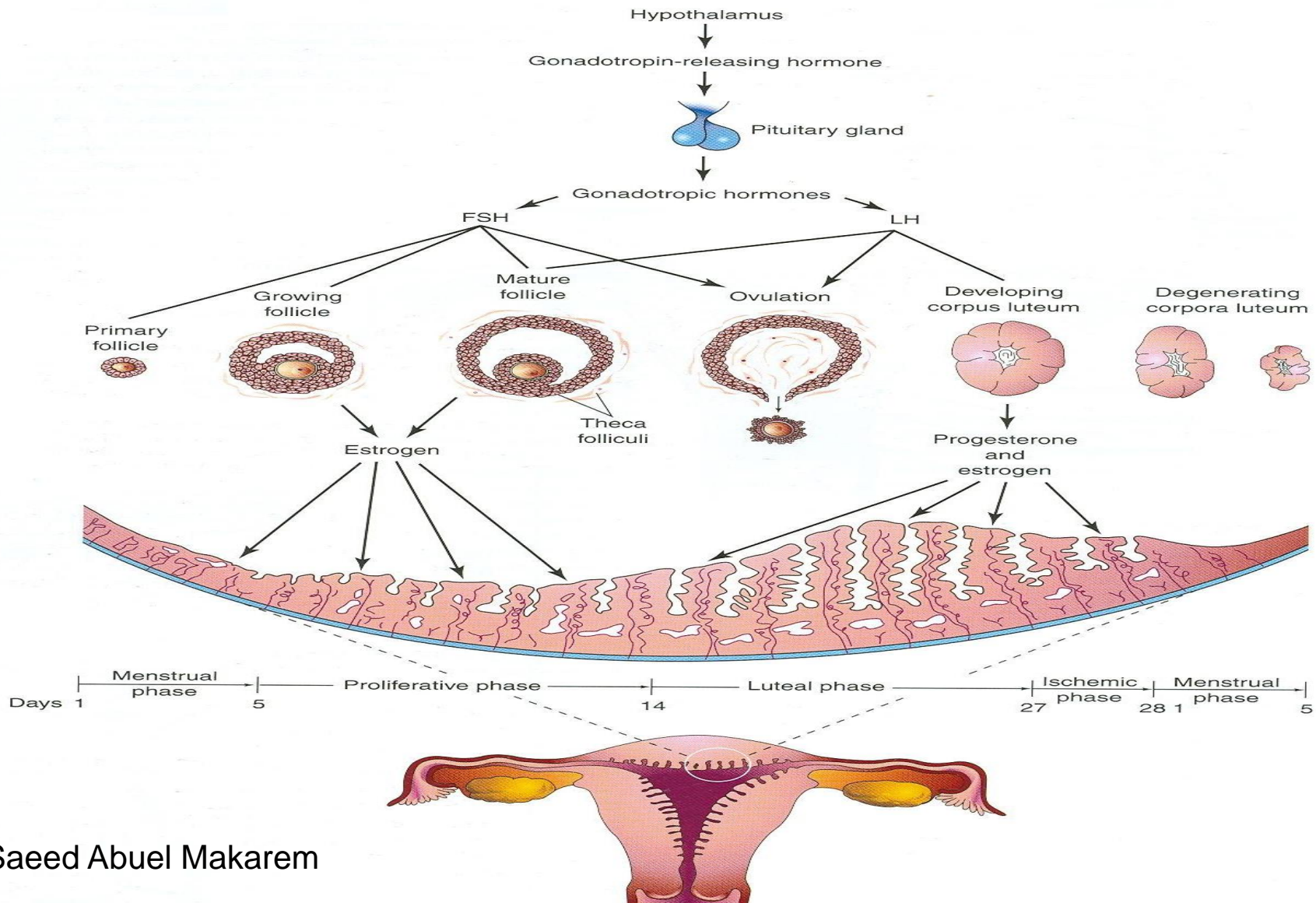


FEMALE CYCLES & GAMETOGENESIS



OBJECTIVES

By the end of the lecture, you should be able to:

- Describe the female cycles (**Ovarian & Uterine**).
- Define **gametogenesis**.
- Differentiate the types of **gametogenesis**.
- Describe the process of **spermatogenesis**.
- Describe the process of **oogenesis**.

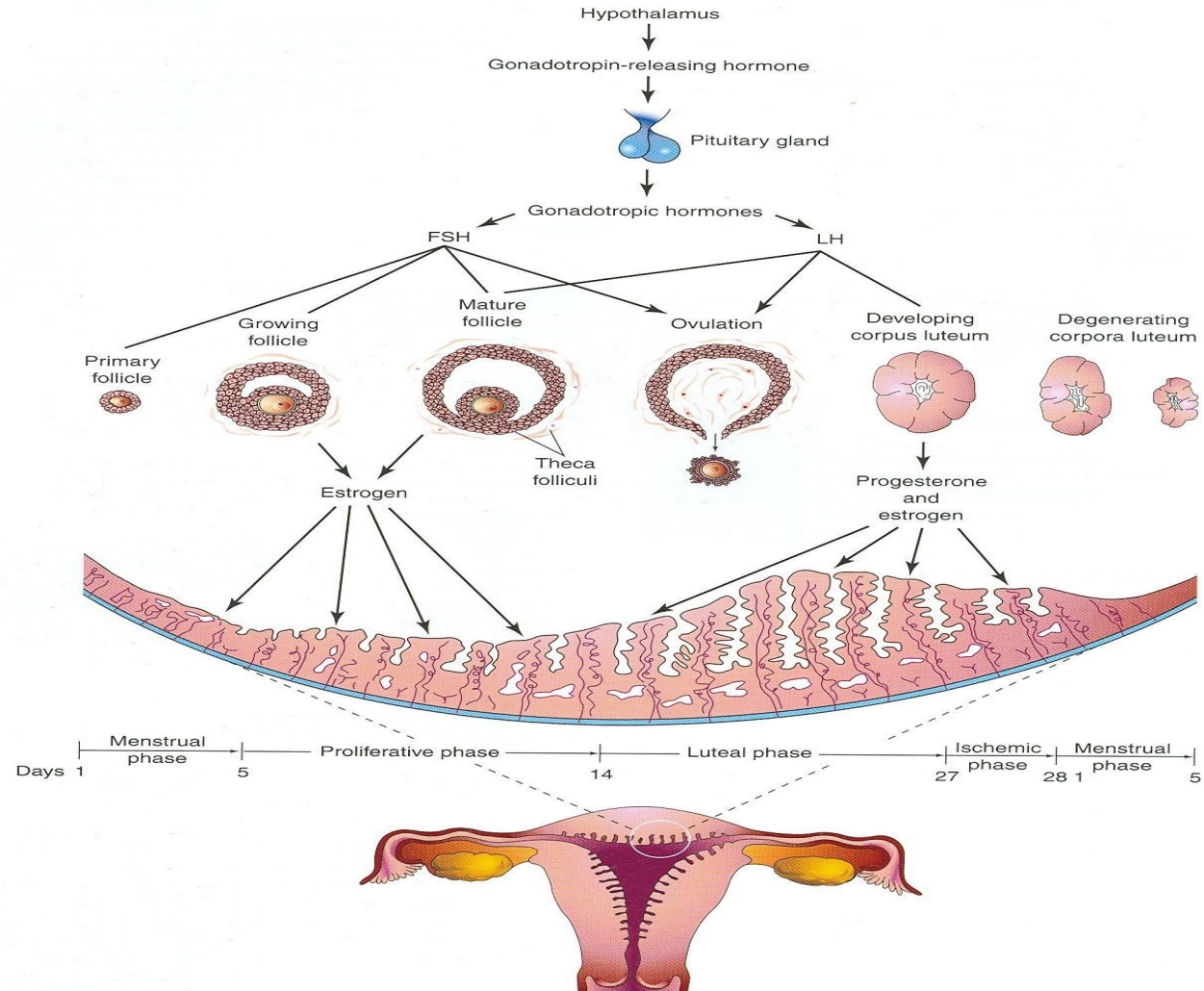
Health is a great valuable thing, we never have a true idea of its value until we lose it.

Female Reproductive Cycles

OVARIAN AND UTERINE CYCLES

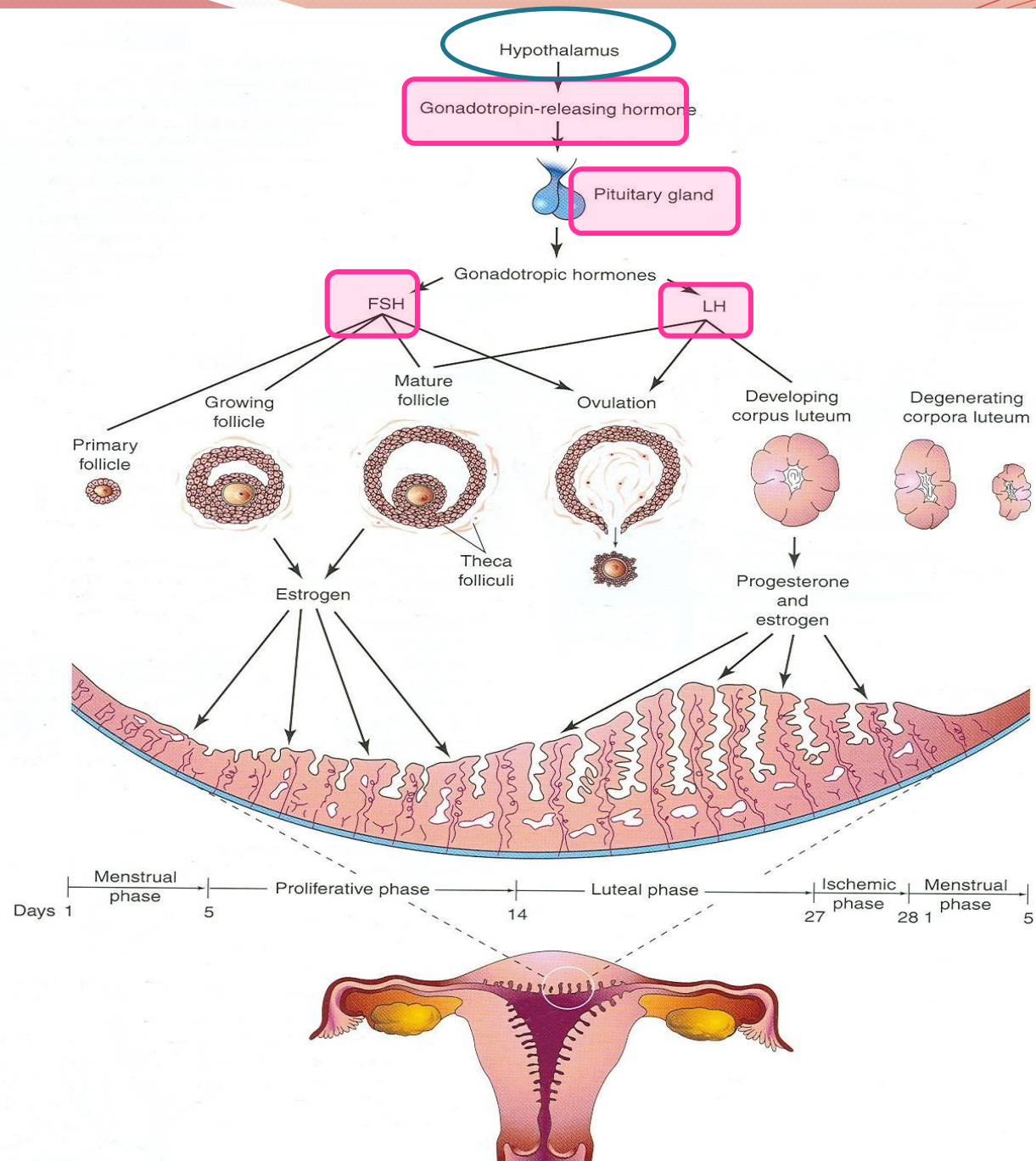
- **The** reproductive cycles start at puberty !.
- Normally continues until **menopause**.
- Reproductive cycles depend upon activities & coordination of:

1. Hypothalamus,
2. Pituitary gland,
3. Ovaries,
4. Uterus,
5. Uterine tubes,
6. Vagina and
7. Mammary glands.

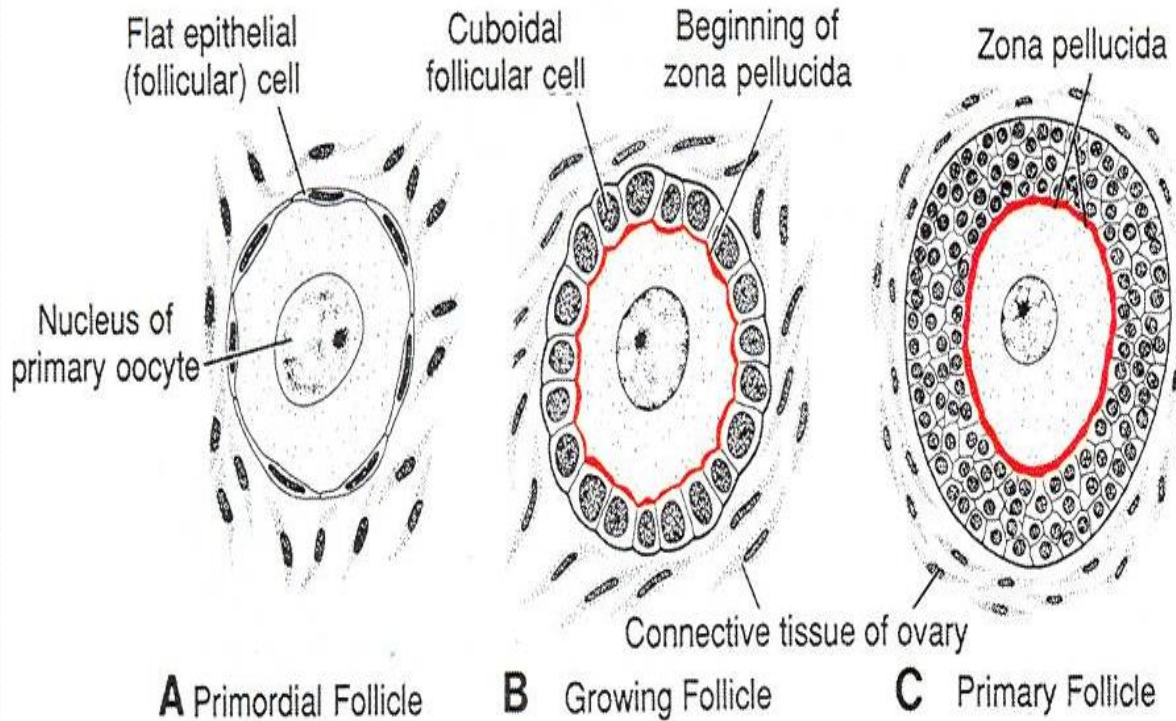


GnRH

- **Gonadotrophin-releasing hormone (GnRH)** is synthesized by neurosecretory cells of the **Hypothalamus**.
- Carried to the **Pituitary gland** (anterior lobe).
- It stimulates the pituitary to release **Two Hormones** that act on **Ovaries** (FSH & LH)



OVARIAN CYCLE



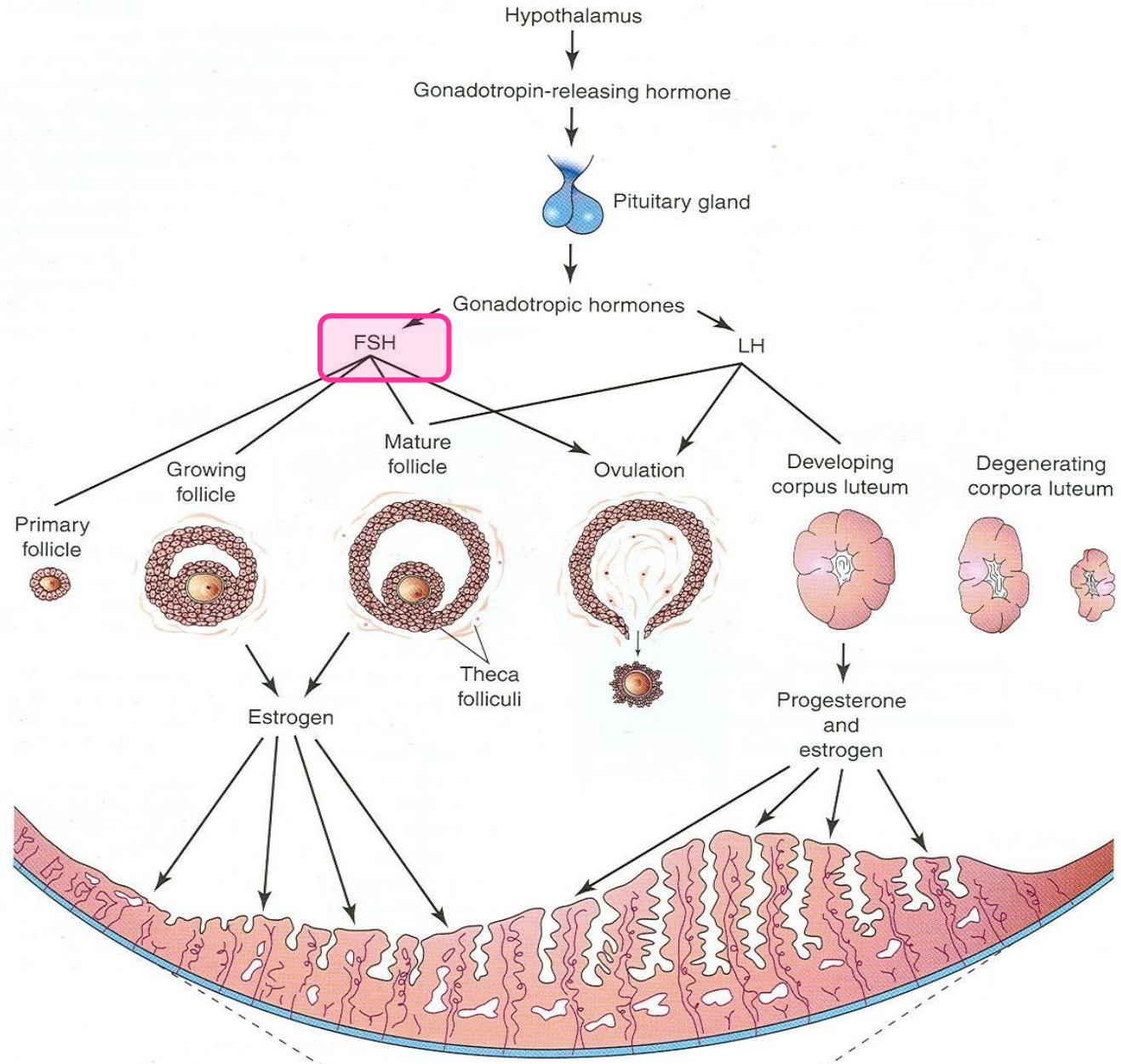
After puberty the simple flat follicular cells become cuboidal, then columnar then forming many layers around the oocyte.

- The ovarian cycle is under the control of the **Pituitary Gland**.
- **It is divided into 3 phases: (FOL)**
 - 1- Follicular, phase.
 - 2- Ovulatory, phase.
 - 3- Luteal phase.
- The ovarian cortex contains hundreds of thousands of primary follicles (400,000 to 500,000).
- Each consists of one **primary oocyte** encircled by single layer of flat follicular cells.

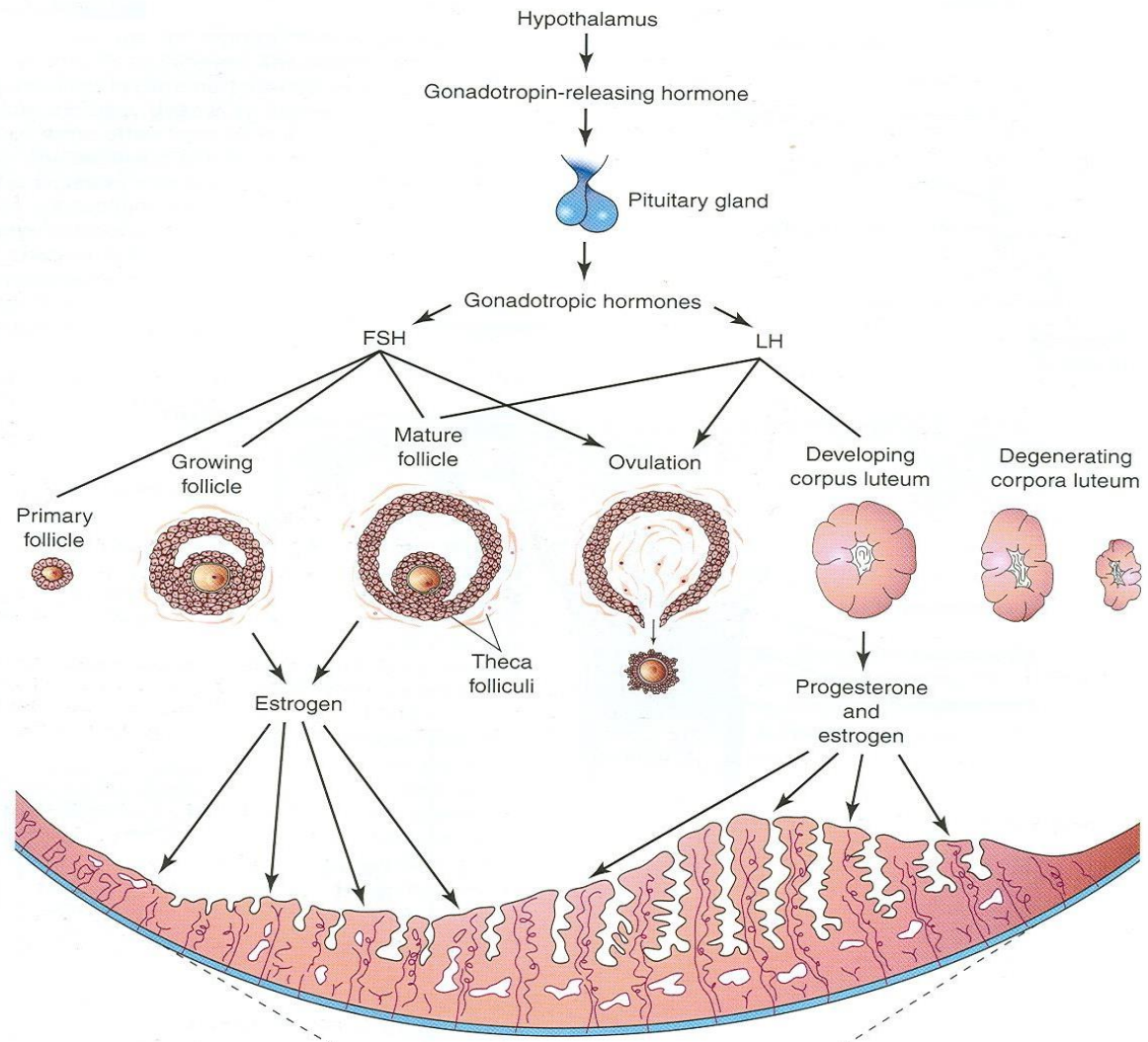
FSH

- Follicle-Stimulating Hormone .
- It is secreted by the pituitary gland.

- **FUNCTIONS:**
It stimulates the primary (ovarian) follicles:
 - 1- To develop & mature.
 - 2- To produce Estrogen by its follicular cells.



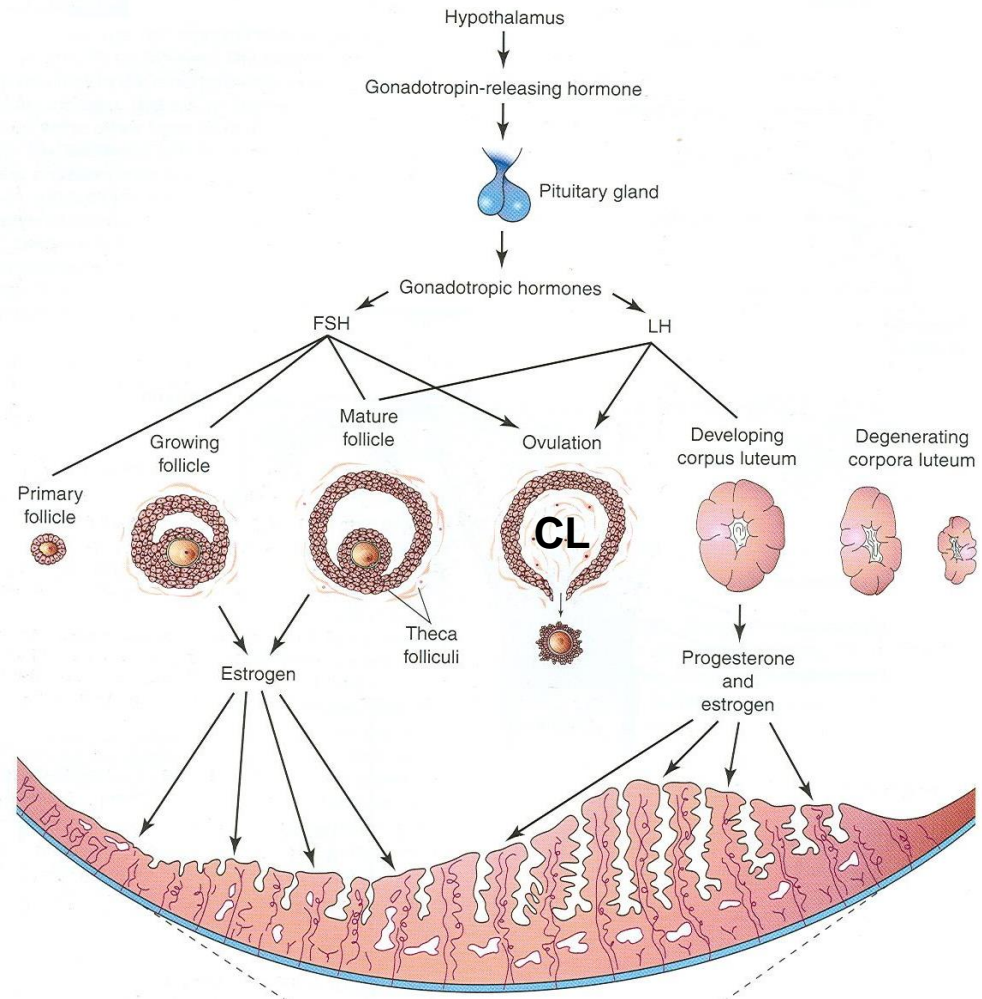
- The follicle becomes enlarged until it gets full maturity.
- It produces swelling on the surface of the ovary.
- Early development of ovarian follicle is induced by **FSH**.
- **Final** stages of maturation require **LH (luteinizing hormone)**.
- **LH**. Also secreted by the pituitary gland.
- It causes **ovulation** (rupture of the mature follicle).



Growing follicles produce **estrogen** which regulates the development and functions of the reproductive organs.

Corpus Luteum

- Now the remaining part of the ruptured follicle is called **corpus luteum, (CL)**.
- It secretes **Progesterone** and small amount of **Estrogen**.
- These **2** hormones stimulate endometrial glands to secrete and prepare the endometrium for implantation of the **fertilized Ovum** (Blastocyst).
- If the oocyte is fertilized the Corpus Luteum enlarges and remains till the **4th month** of pregnancy.
- If the oocyte is not fertilized the corpus luteum involutes and degenerates in **10-12** days and called corpus albicans.



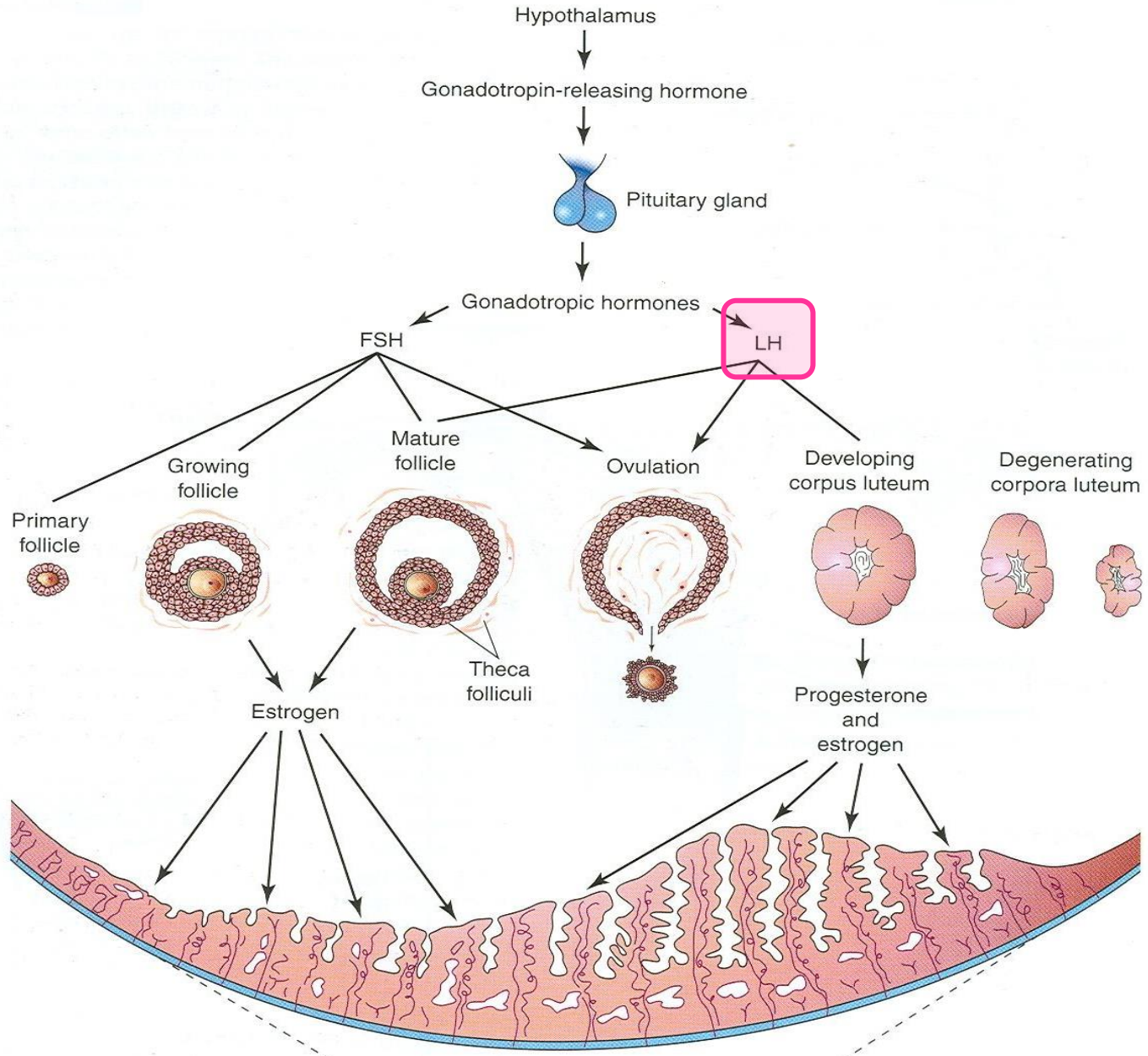
LH

- **Luteinizing Hormone.**

- **FUNCTIONS:**

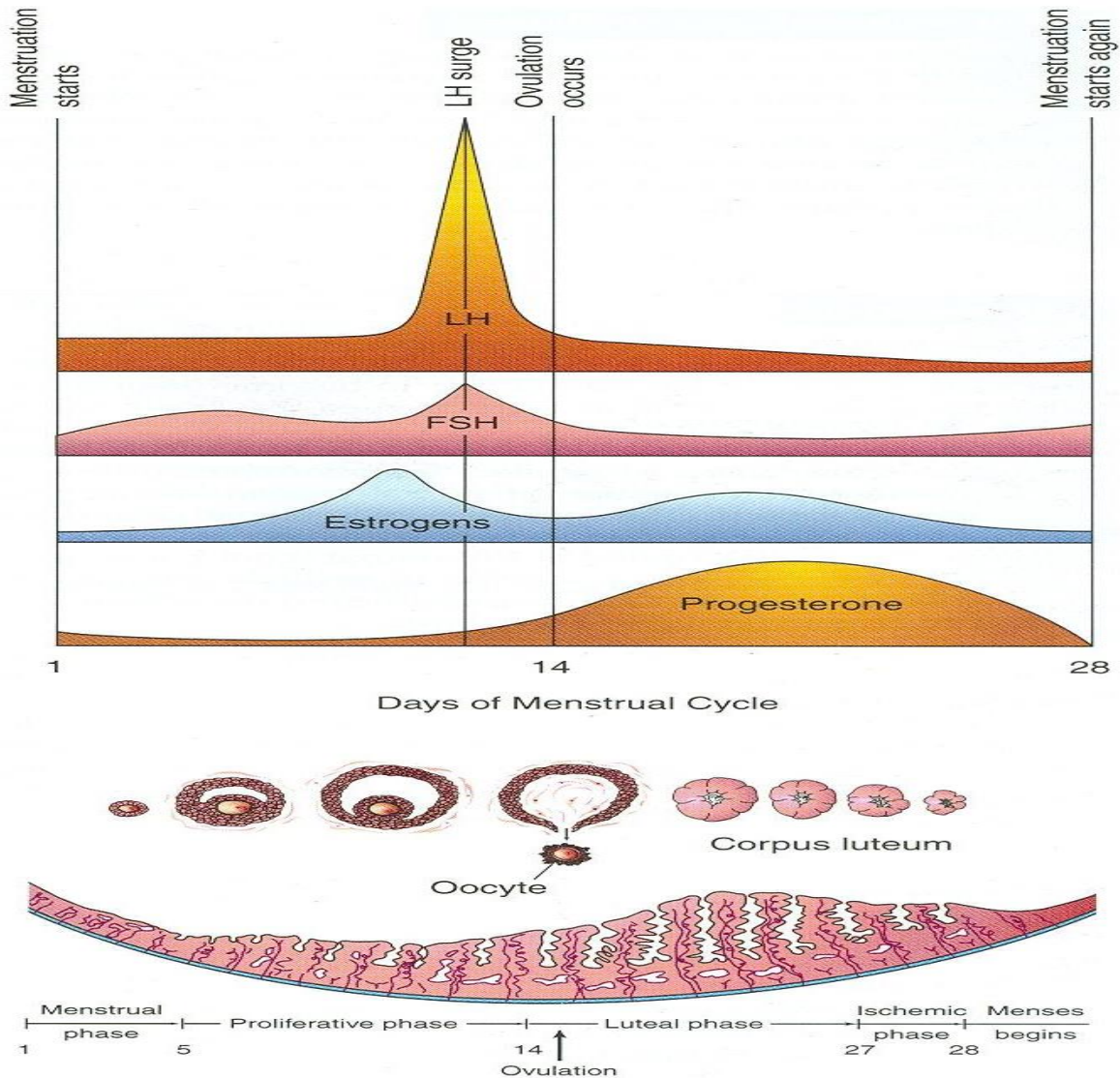
- 1- It serves as the trigger for **ovulation.**

- 2- Stimulates the follicular cells and corpus luteum to produce **Progesterone.**



Uterine or Menstrual Cycle

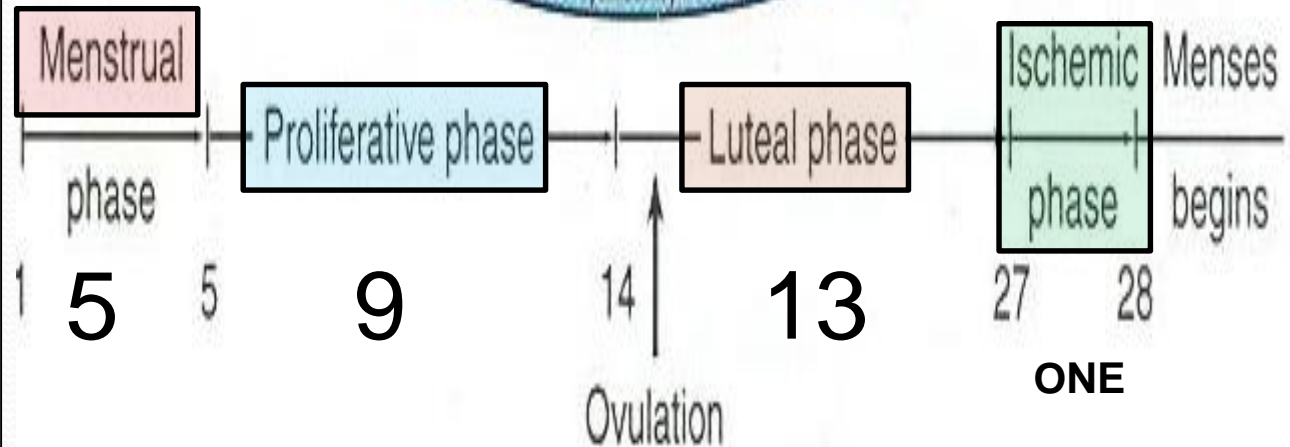
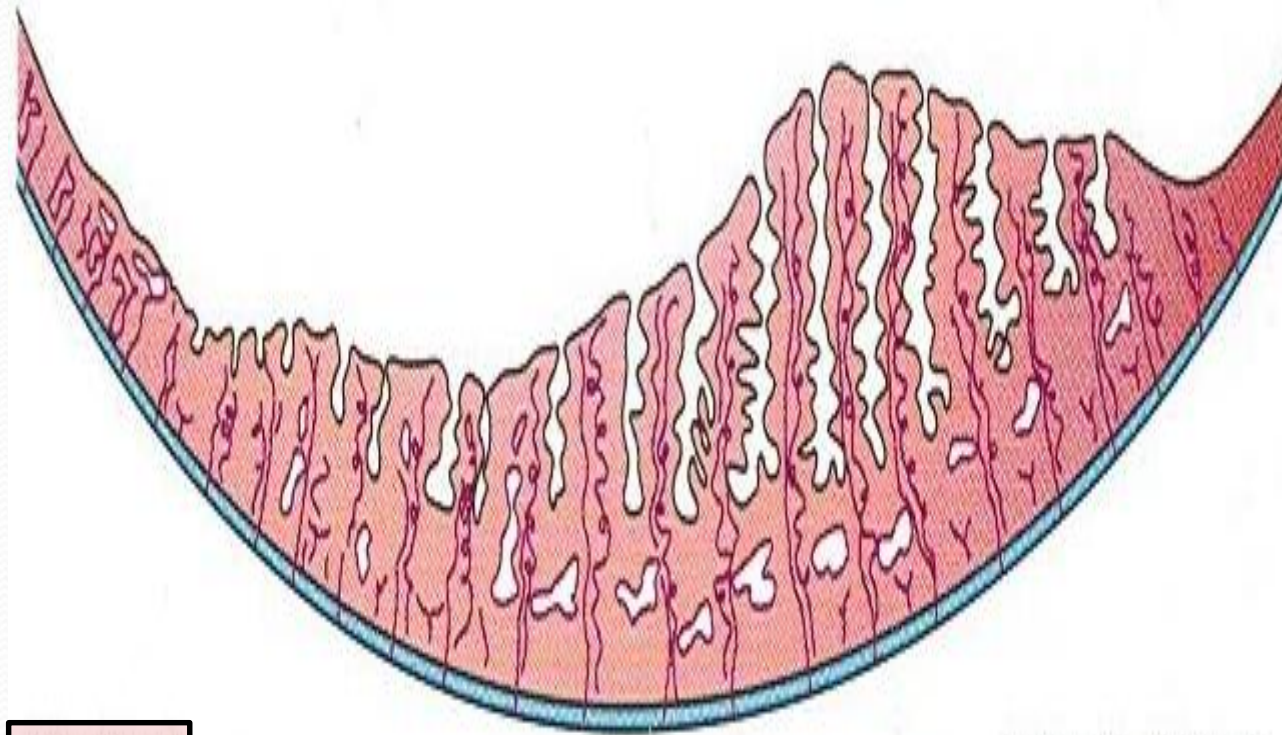
- It is the cyclic changes which occur in the endometrium of the uterus by the effect of estrogen & progesterone.
- Average menstrual cycle is about 28 days.
- **Day One** is the day when **menstrual blood** flow begins.
- It varies by several days in normal women.
- Ranges between **23** and **35** days in 90 % of women.
- It sometimes varies in the same woman.



Phases of Menstrual Cycle

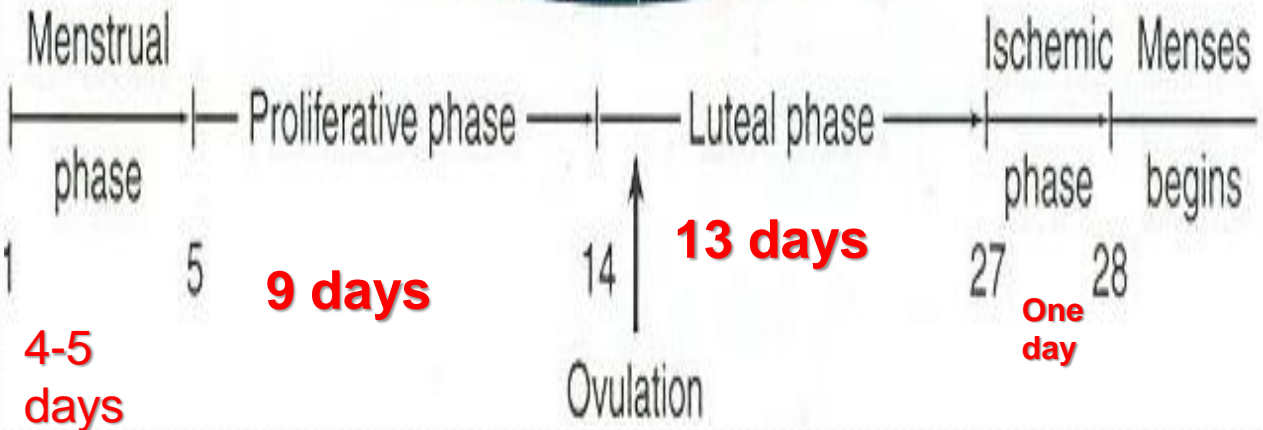
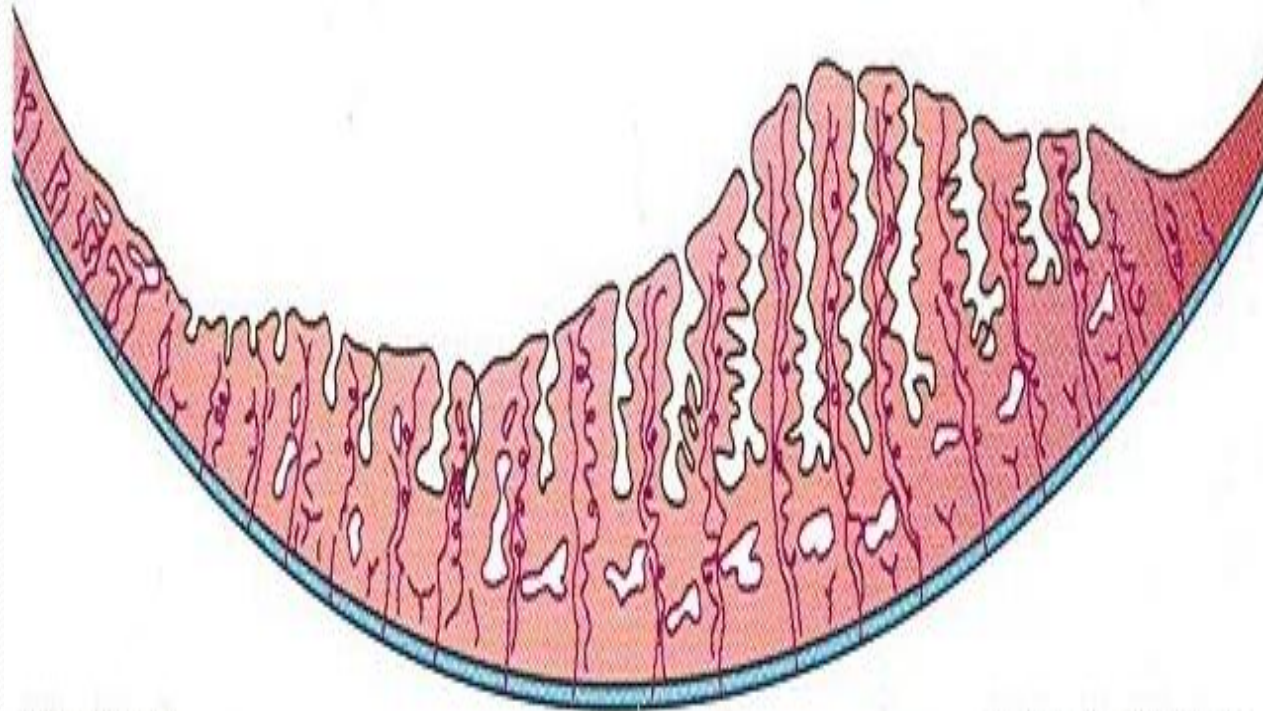
Four phases:

1. **Menstrual Phase**, (5 days).
2. **Proliferative or Follicular Phase**. (9 days).
3. **Luteal Phase**, (13 days).
4. **Ischemic Phase**, (1 day).



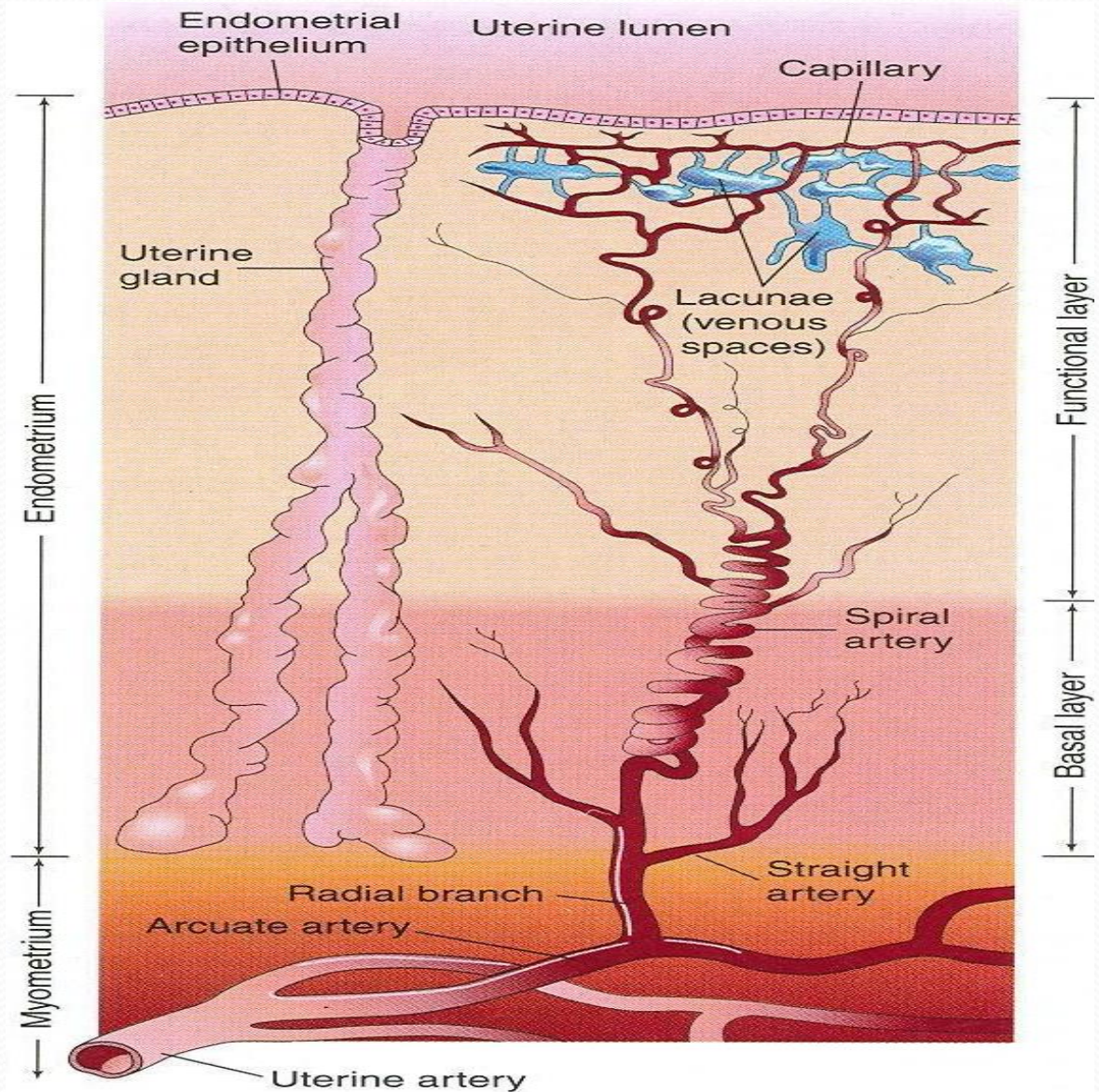
Menstrual Phase

- Starts with the 1st day of menstruation.
- Lasts for 4 to 5 days.
- The functional layer of the endometrium is sloughed off and discarded with the menstrual flow.
- Blood discharge from vagina is combined with small pieces of endometrial tissue.



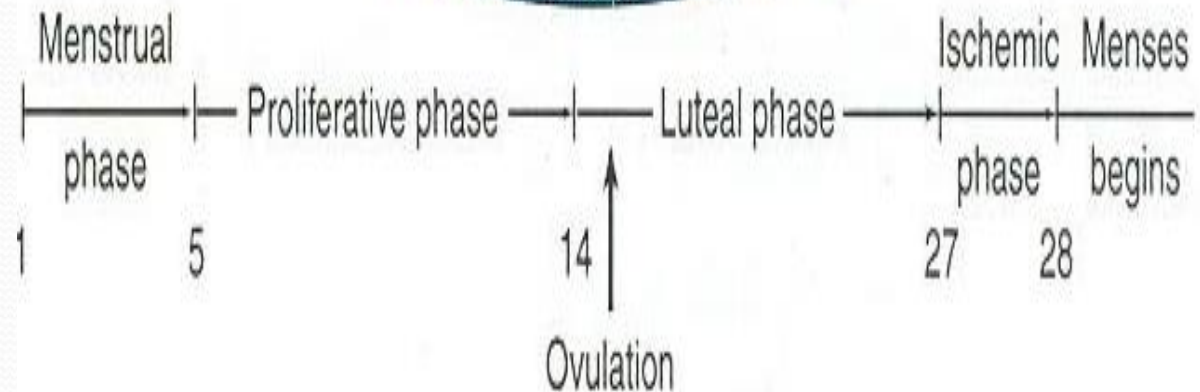
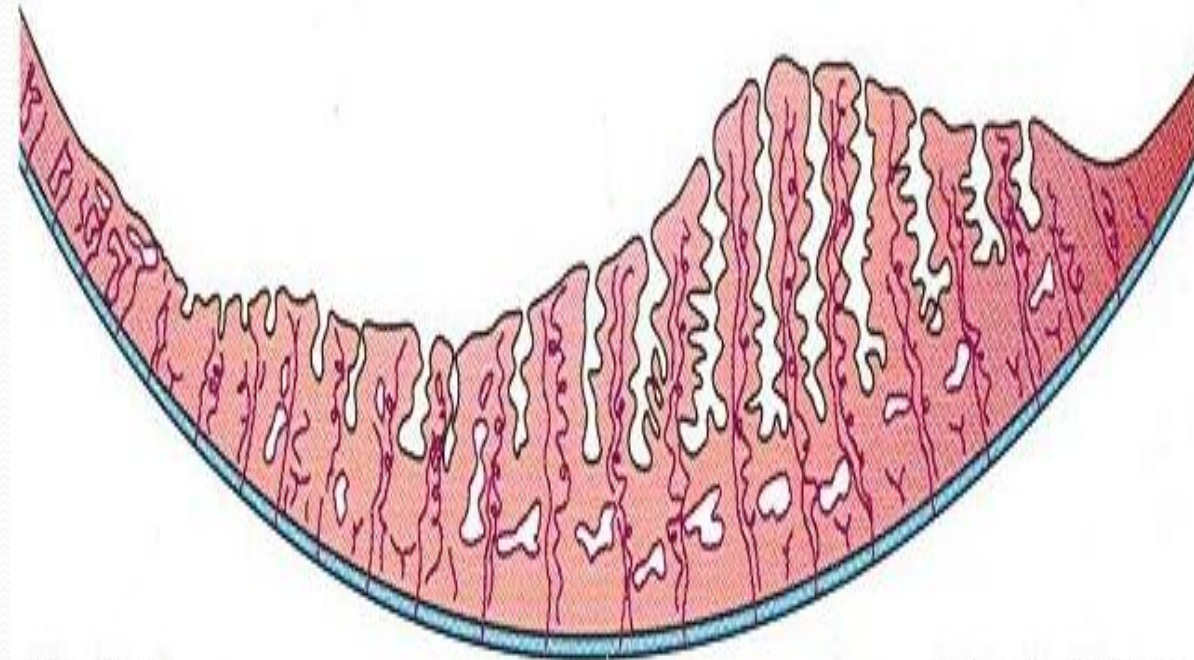
- It is a phase of repair and proliferation.
- It lasts about 9 days.
- Coincides with growth of ovarian follicle.
- **So it is controlled by Estrogen** secreted by the follicular cells.
- Thickness of the endometrium is increased 2-3 times.
- The glands increase in number and length and the spiral arteries elongate.

Proliferative Phase



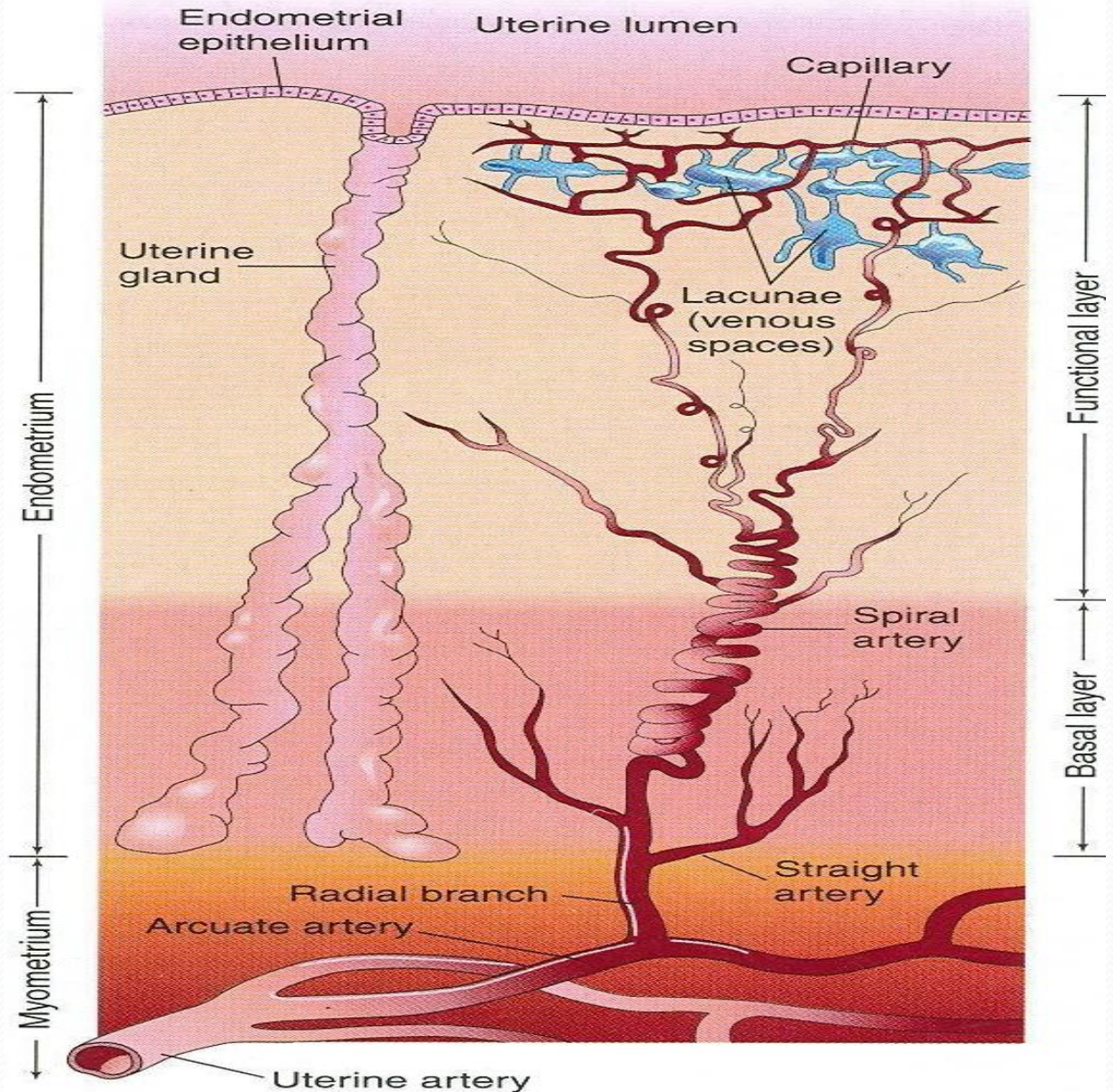
Luteal Phase

- It is a **Secretory or Progesterone phase.**
- It lasts about **13** days.
- Coincides with the formation, growth and functioning of the **Corpus Luteum.**
- Glandular epithelium secrete a material rich in glycogen.
- Endometrium increase in thickness under the influence of progesterone and estrogen.



Luteal Phase

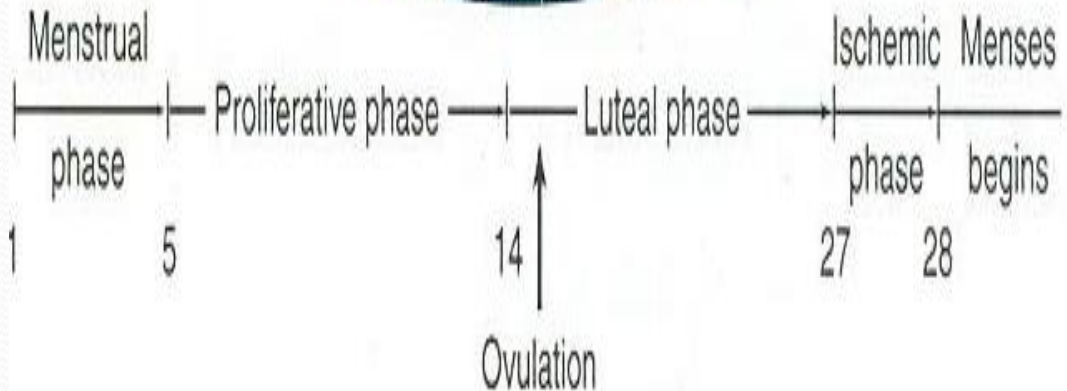
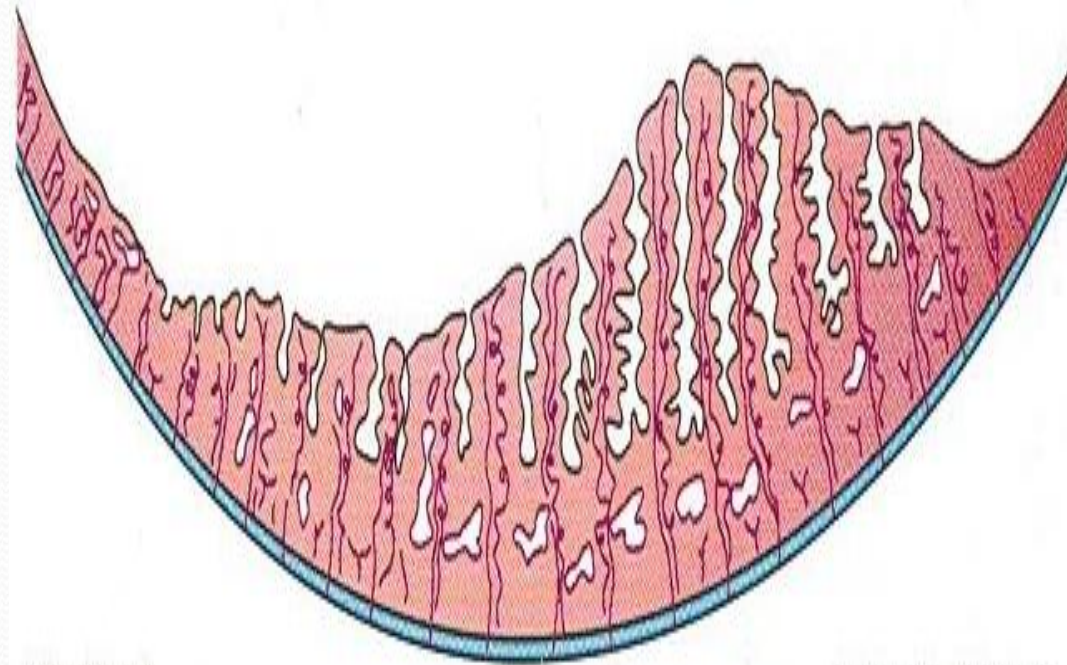
- Spiral arteries grow into the superficial layer of the endometrium.
- Arteries become increasingly coiled.
- Large venous network develops.
- Direct arterio-venous anastomosis is a prominent features.



Ischemic Phase

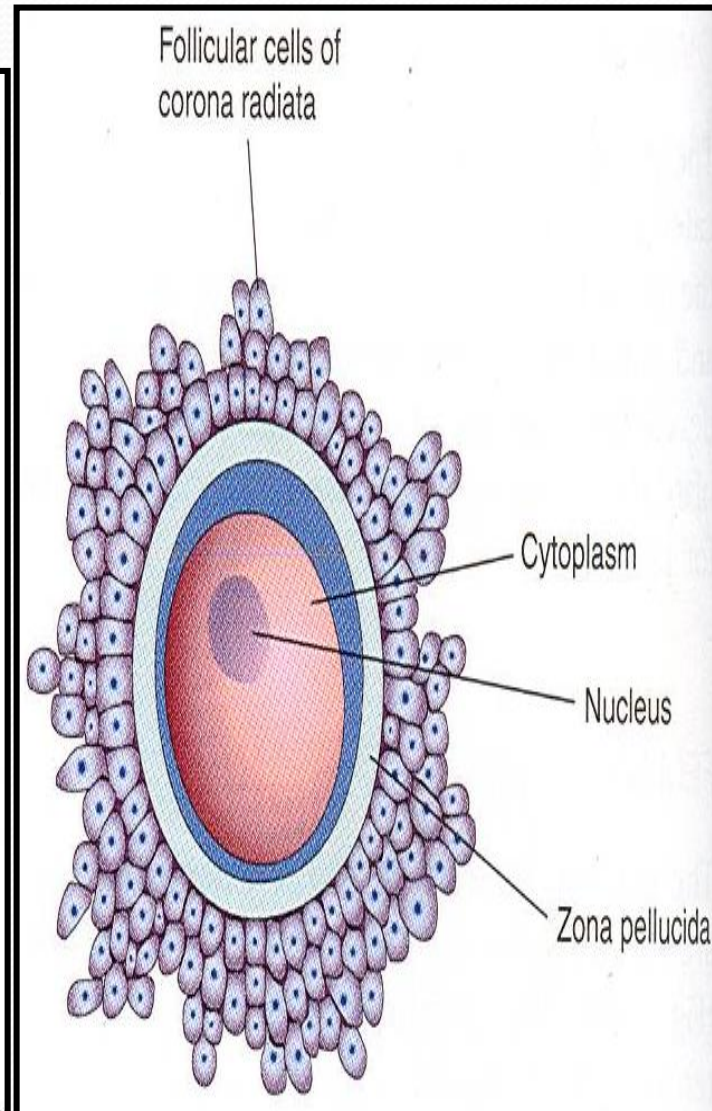
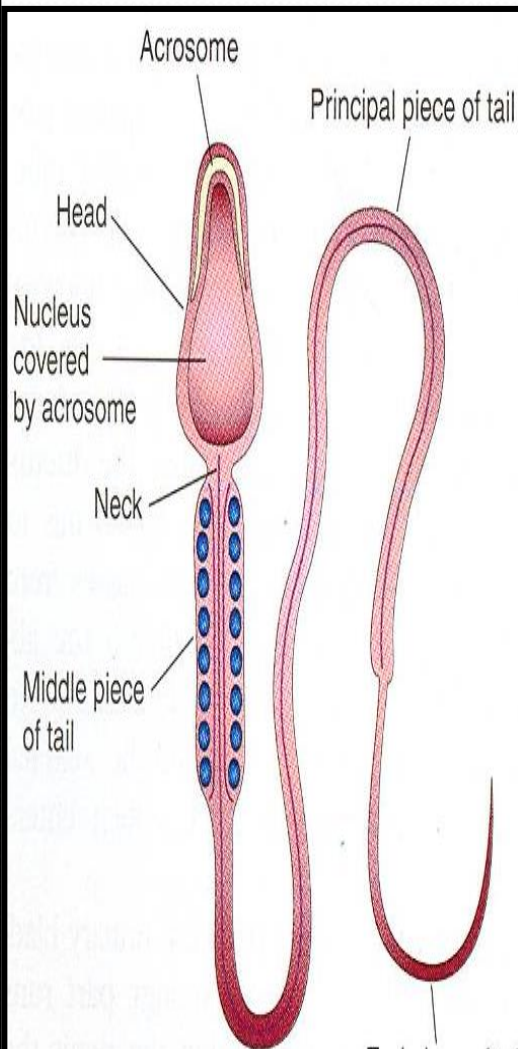
- **Degeneration** of the corpus luteum leads to decrease in the levels of progesterone and estrogen which lead to:

1. Loss of interstitial fluid.
2. Marked shrinking of the endometrium.
3. Spiral arteries become constricted.
4. Venous stasis.
5. Ischemic necrosis.
6. Rupture of damaged vessel wall.
7. Blood seeps into the surrounding connective tissues.
8. Loss of 20-80 ml of blood.
9. Entire compact layer and most of the spongy layer of endometrium is discarded



GAMETOGENESIS

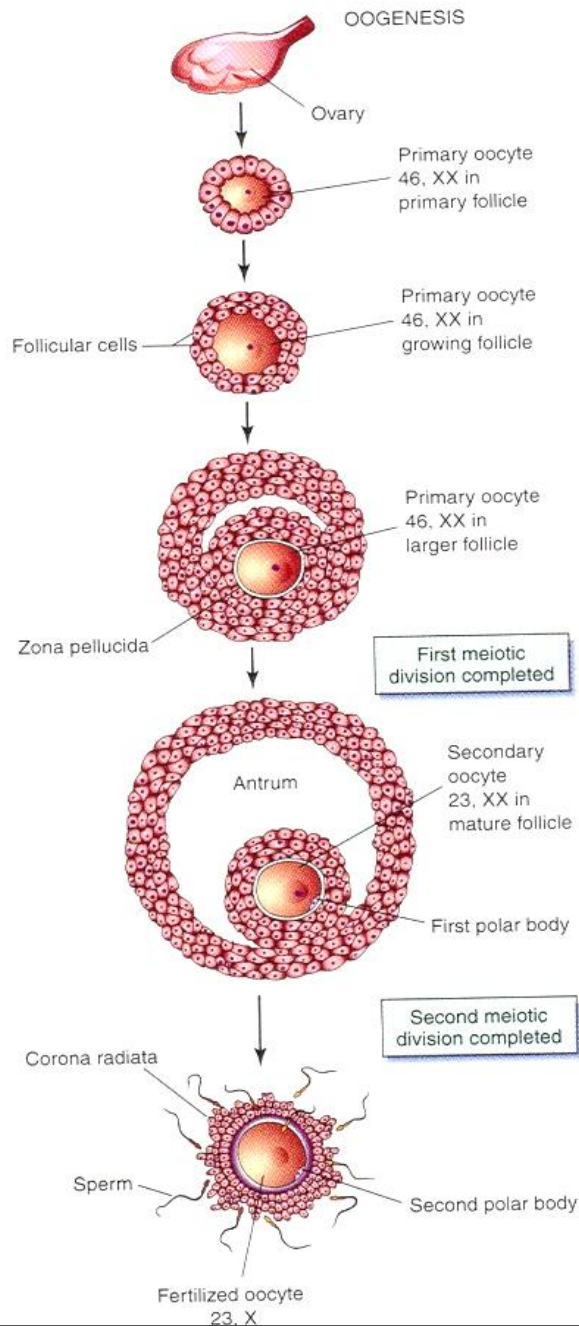
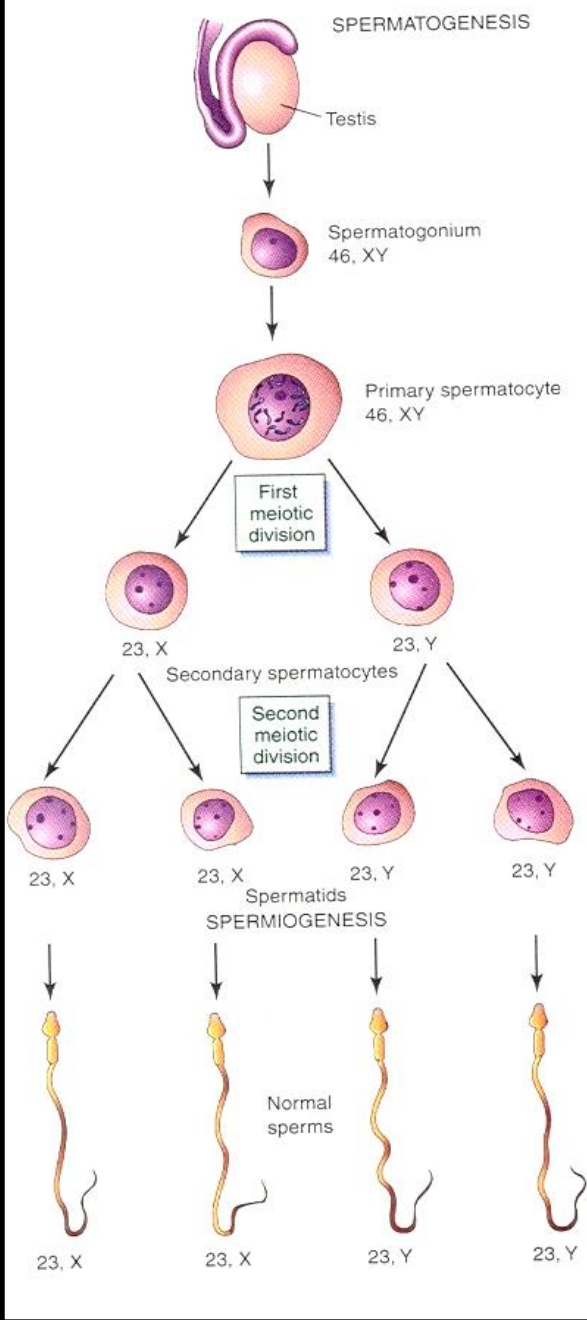
(Gamete Formation)



It is the production of mature male & female gametes (Sperms & Ova).

- **Spermatogenesis:**
- It is the series of changes by which the primitive germ cells (spermatogonia) are transformed into **mature sperms.**
- **Oogenesis:**
- Sequence of events by which the primitive germ cells (**oogonia**) are transformed into **mature oocytes.**

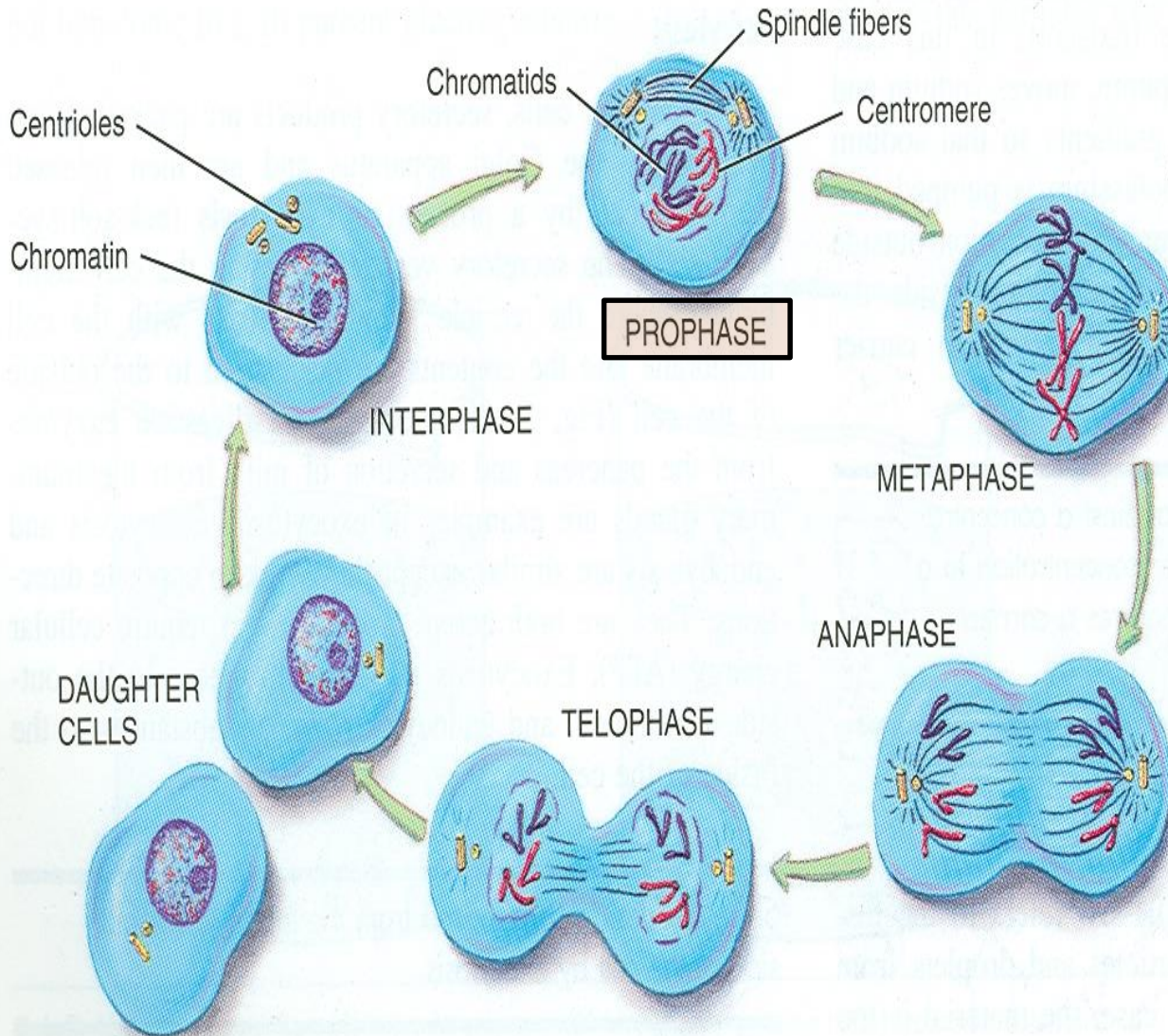
NORMAL GAMETOGENESIS



MEIOSIS

- It is the cell division that takes place in the **germ cells** to produce **male & female gametes**.
- It consists of two cell divisions, **meiosis I & meiosis II**, during which the **Diploid** number of chromosomes (46) is reduced to **Haploid** number (23).

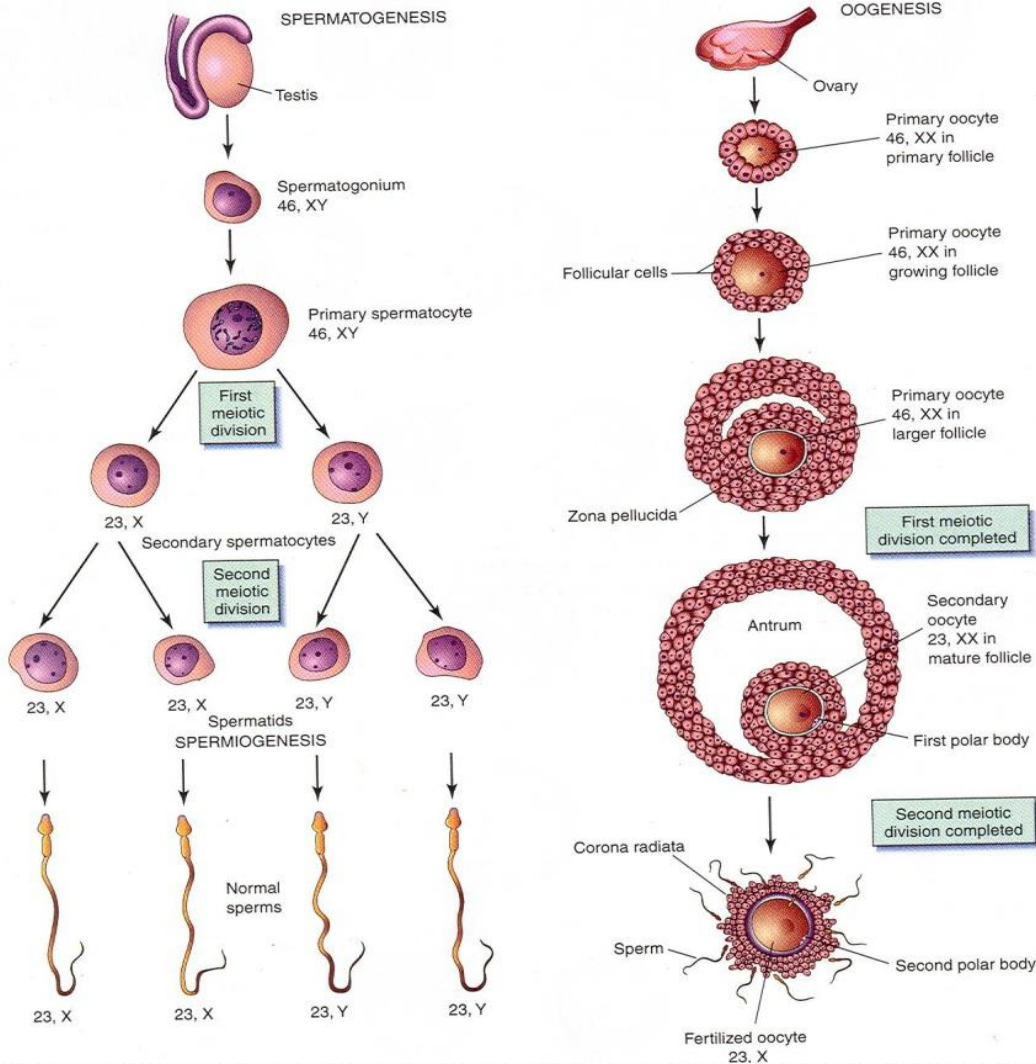
FIRST MEIOTIC DIVISION



At the beginning of meiosis **I**, (**prophase**) male & female germ cells replicate their **DNA** so that each of the 46 chromosomes is duplicated into sister **Chromatid**.

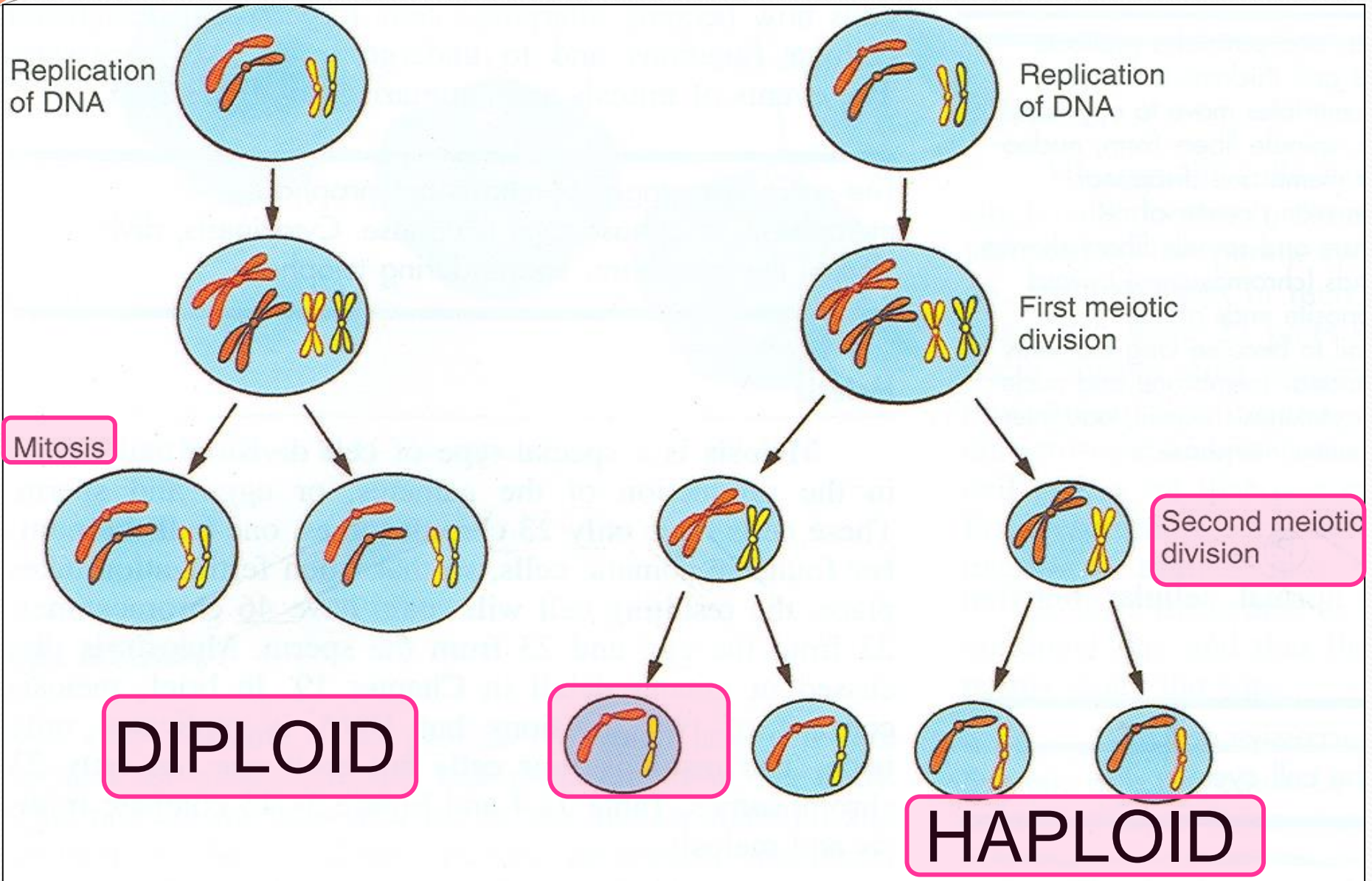
FIRST MEIOTIC DIVISION

NORMAL GAMETOGENESIS

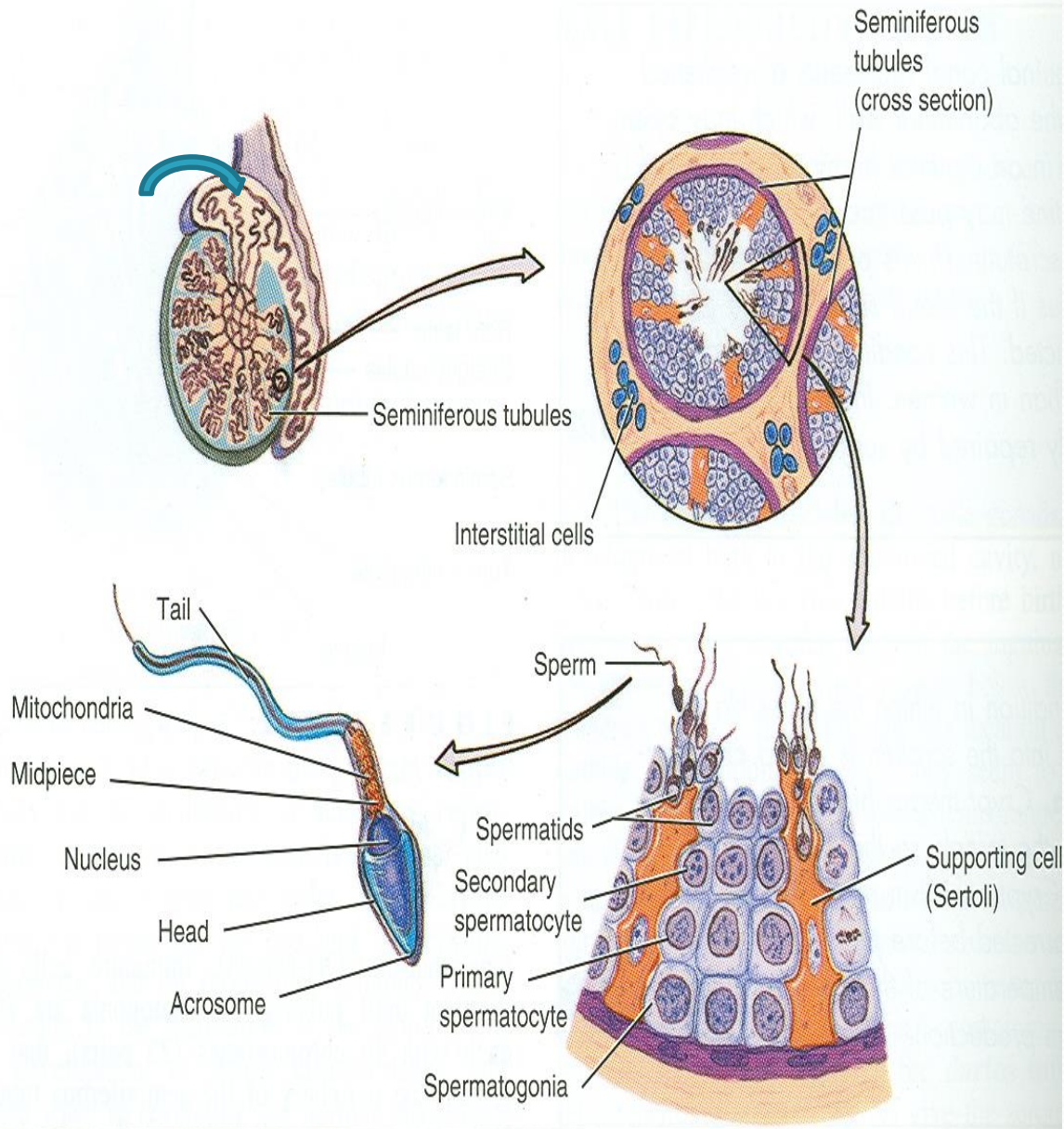


- By the end of the first meiotic division, each new cell formed (**Secondary Spermatocyte or Secondary Oocyte**) has haploid (half) number of chromosome.
- It is half number of chromosomes of the **Primary Spermatocyte or primary Oocyte**.

WHAT IS THE DIFFERENCE BETWEEN MITOSIS & MEIOSIS?

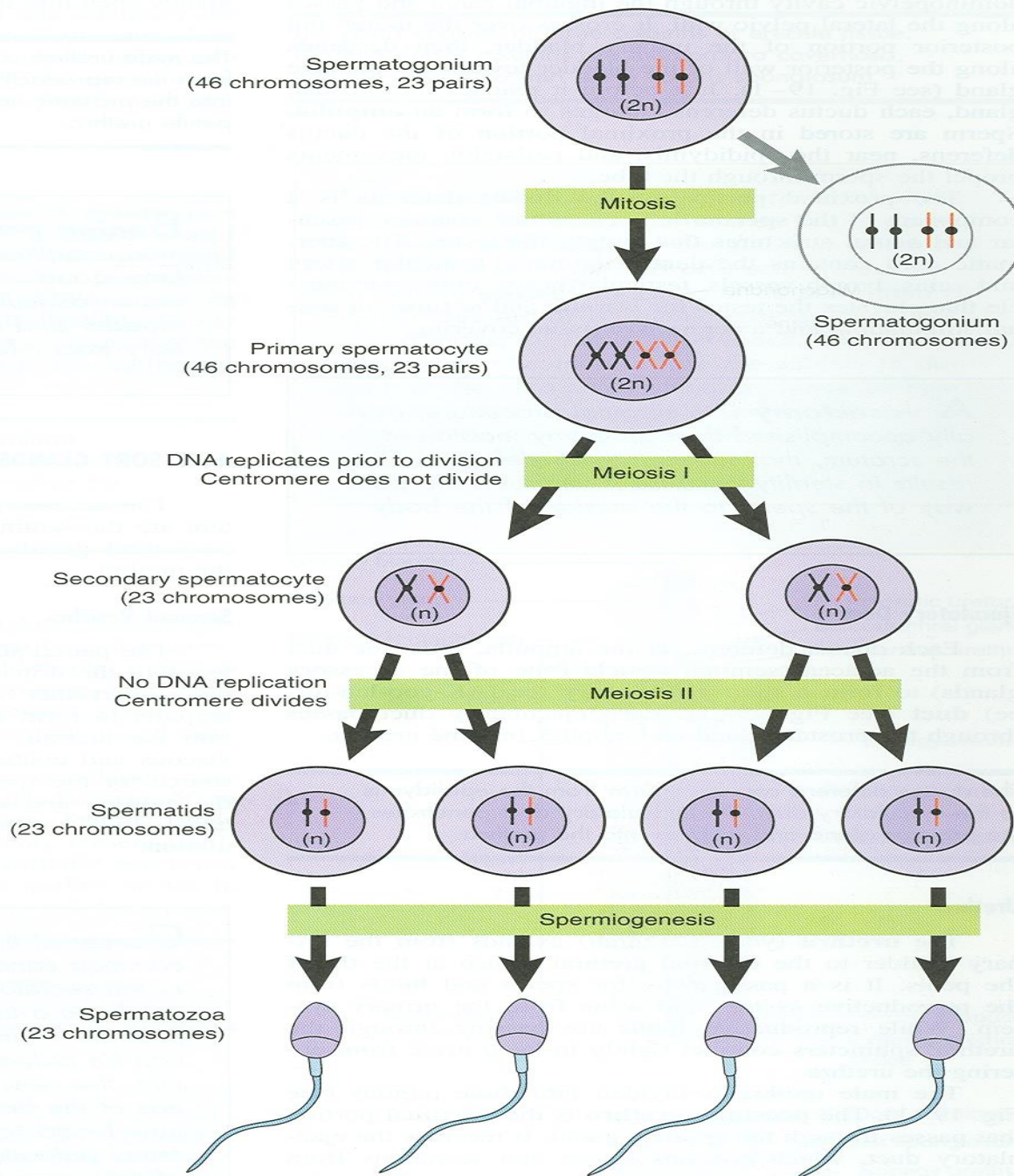


SPERMATOGENESIS



- **AIM:**
- Formation of sperms with haploid number of chromosomes.
- **SITE:**
- Seminiferous tubules of the testis.
- **TIME:**
- From puberty till old age.
- **DURATION:**
- **About two months.**
- **N.B.**
- **Sperms are stored and become functionally mature in the Epididymis.**

SPERMATOGENESIS



- Each **spermatogonium** divides by mitosis into 2 daughter Spermatogonia
- Each daughter spermatogonia grows to give rise to **primary spermatocyte (46)**.
- -----
- Primary spermatocyte undergoes **meiosis I** to give rise to **secondary spermatocyte (22+ x) or (22+y)**.
- Each **secondary spermatocyte** undergoes **meiosis II** to give **spermatid (23)**.

SPERMIOGENESIS

Golgi region

Acrosome

Residual cytoplasm

Nucleus

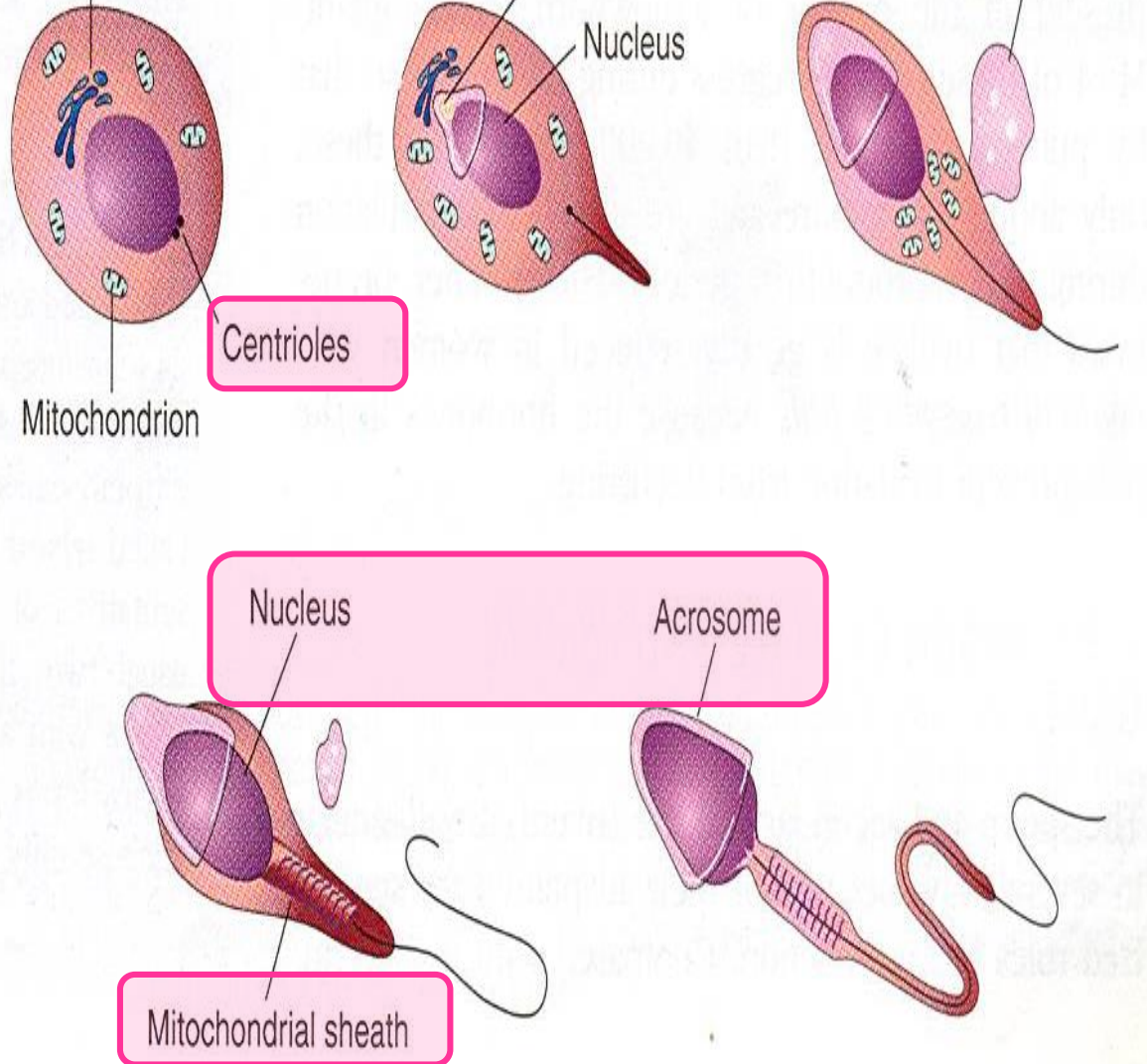
Centrioles

Mitochondrion

Nucleus

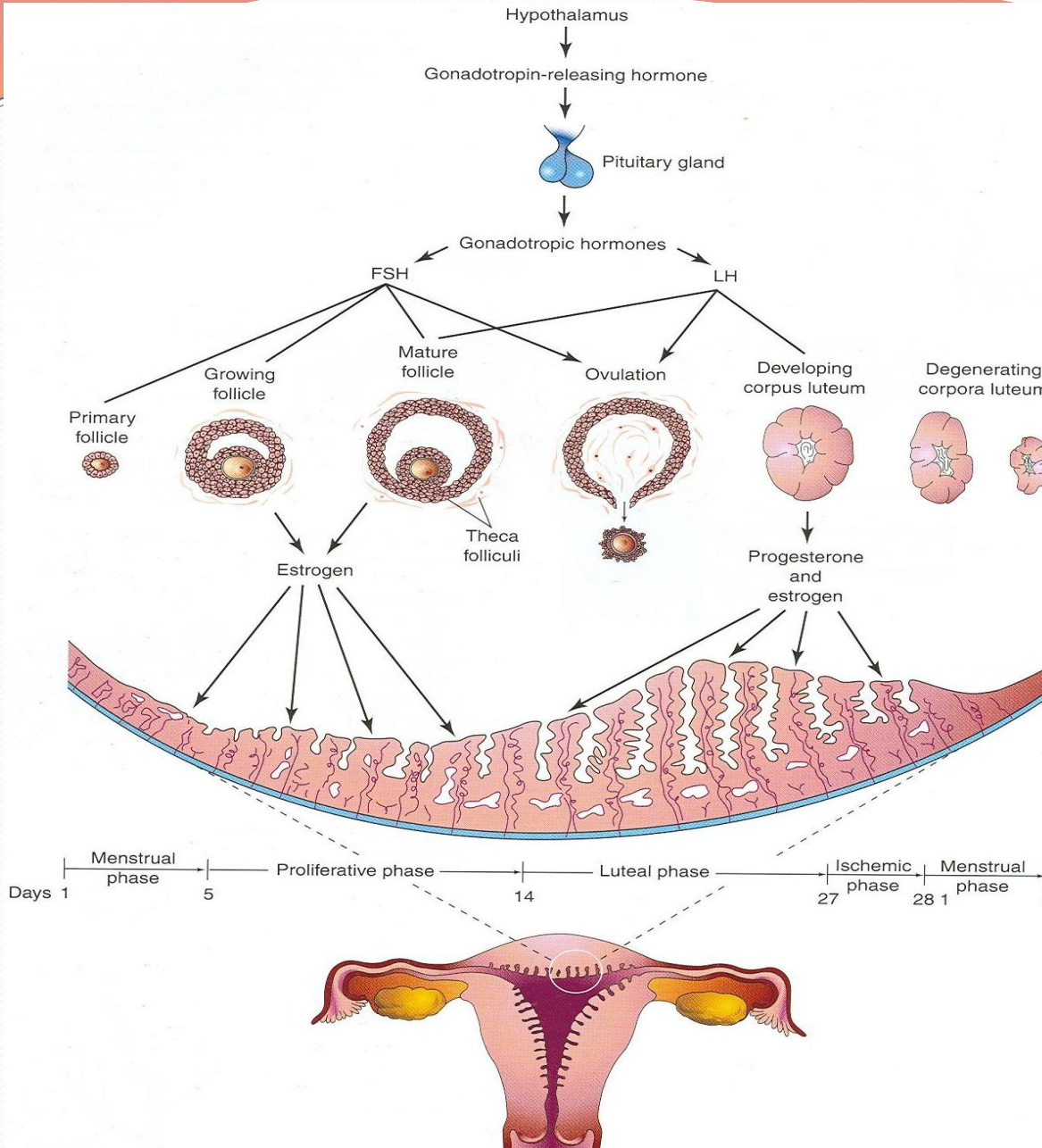
Acrosome

Mitochondrial sheath



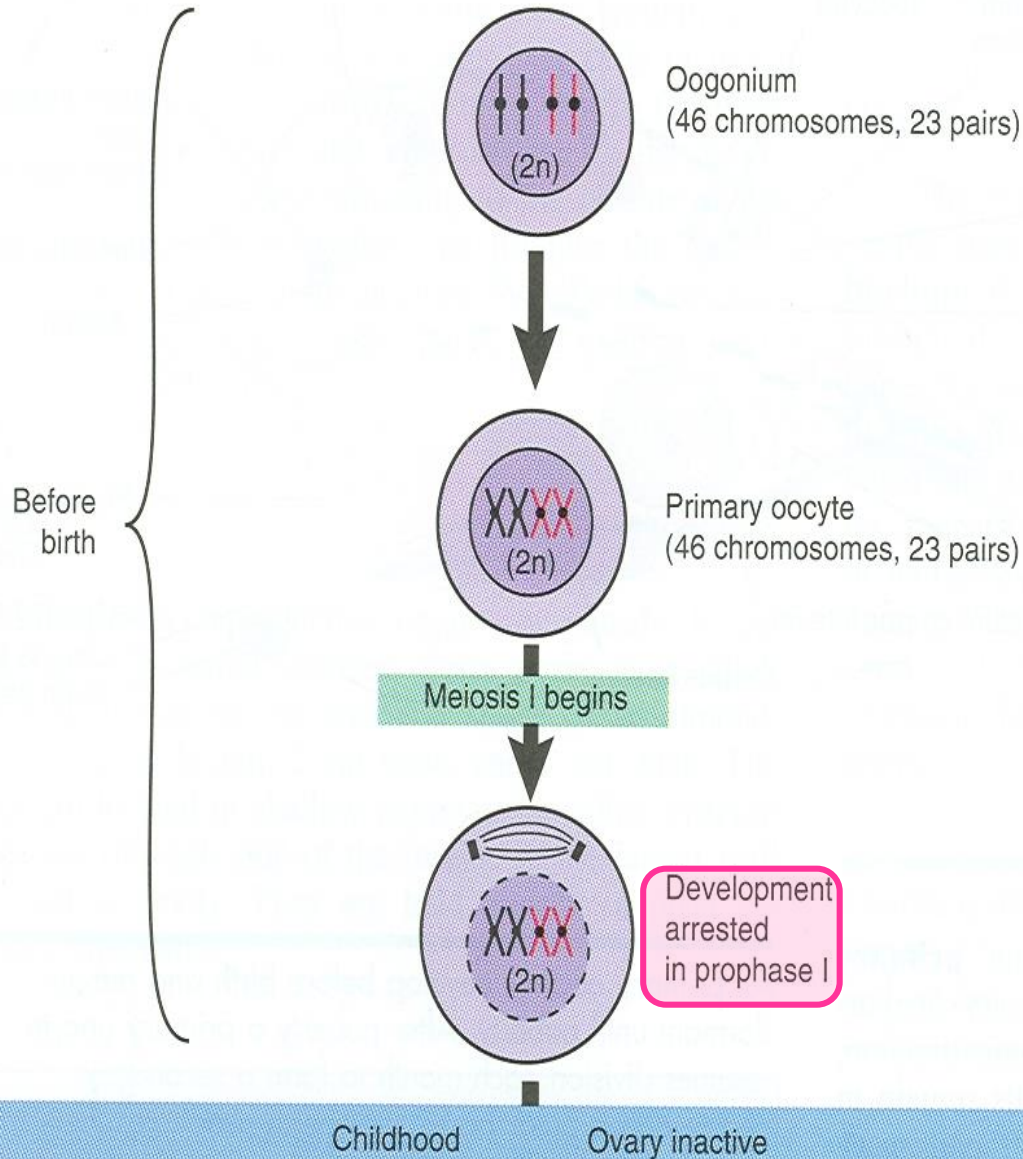
- It is **change in shape (metamorphosis)** through which the Spermatids are transformed into **mature Sperms:**
 1. **Nucleus** is condensed and forms most of the head.
 2. **Golgi apparatus** forms the Acrosome, (acrosomal cap).
 3. **Mitochondria** forms a spiral sheath.
 4. **Centriole** elongates to form the axial filament.

OOGENESIS



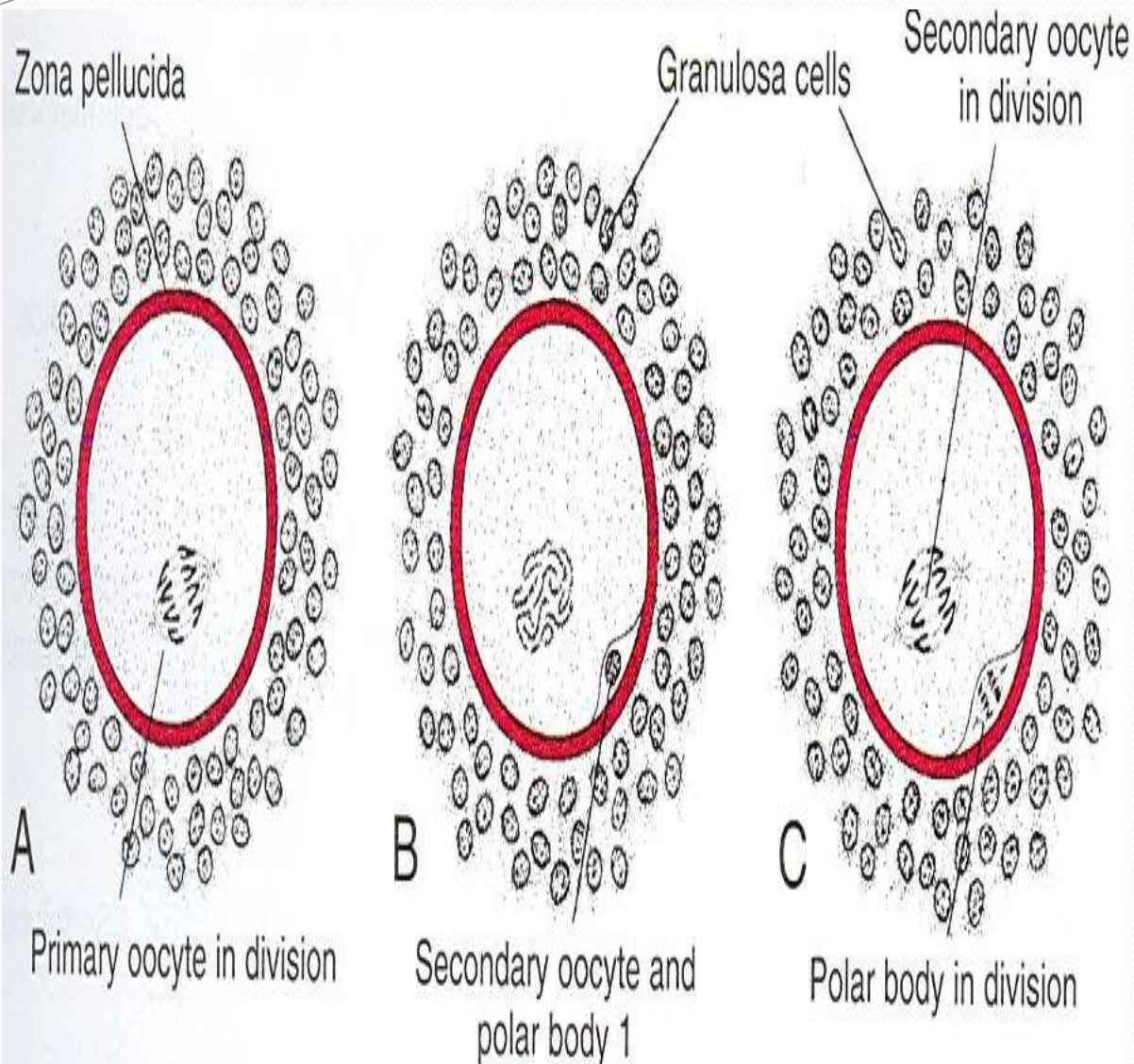
- **AIM:**
- Formation of **secondary oocytes** with haploid number of chromosomes.
- **SITE:**
- Cortex of the ovary
- **TIME:**
- Starts very early during fetal life becomes completed after puberty & continues until menopause.
- NB. It occurs monthly **Except** during pregnancy.

OOGENESIS



- **Before Birth:** During early fetal life, primitive ova (**Oogonia**) proliferate by mitotic division and enlarge to form **Primary Oocytes (46)**.
- **At Birth** all primary oocytes have completed the **prophase** of the **1st meiotic division** and remain arrested at **prophase** and do not finish their first meiotic division until puberty.

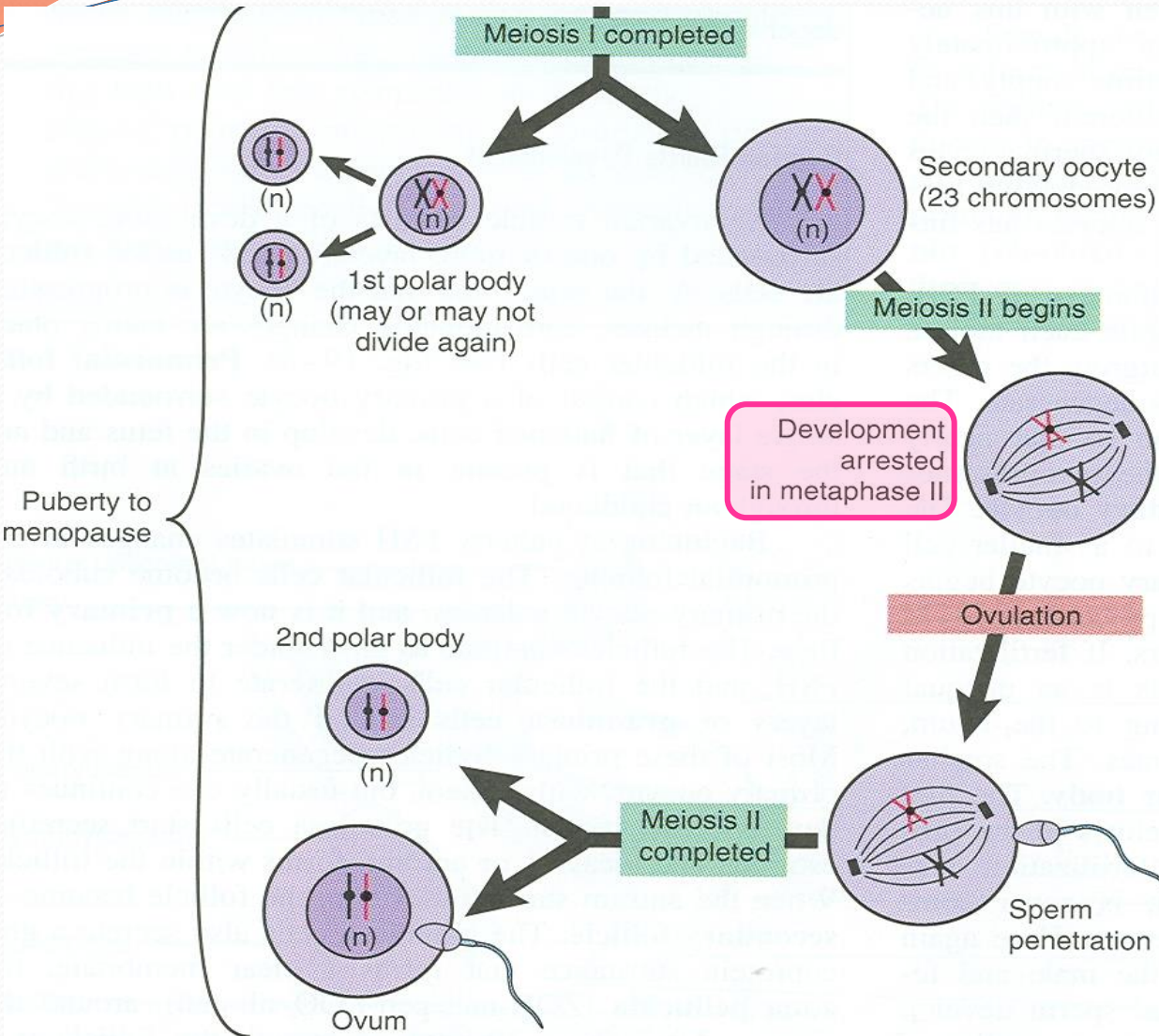
OOGENESIS



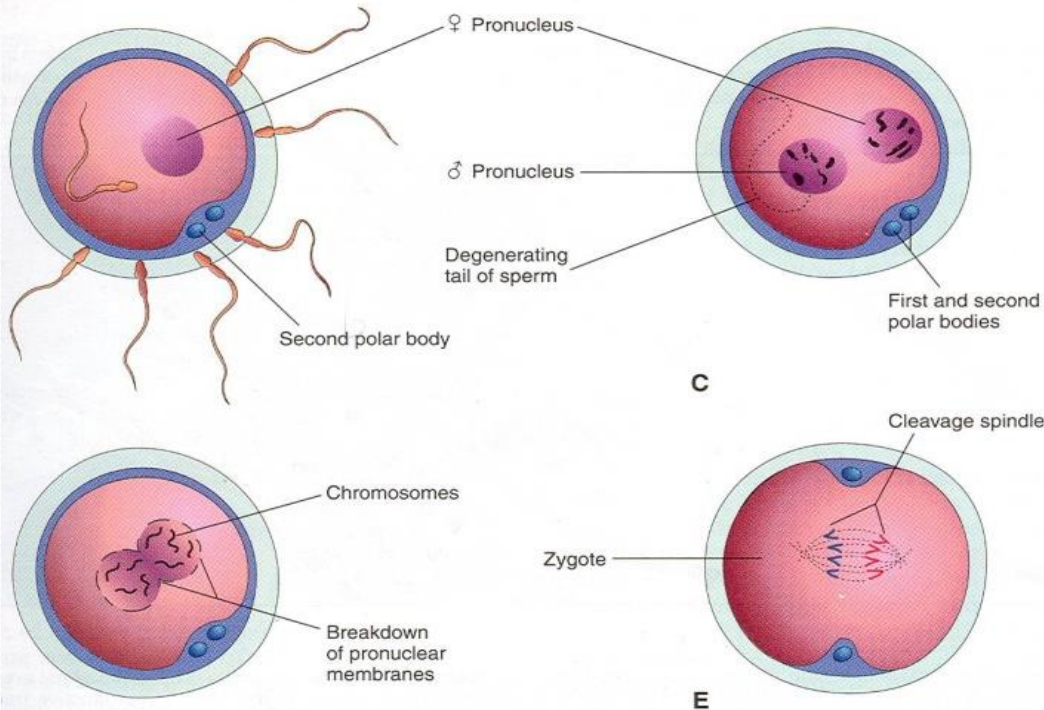
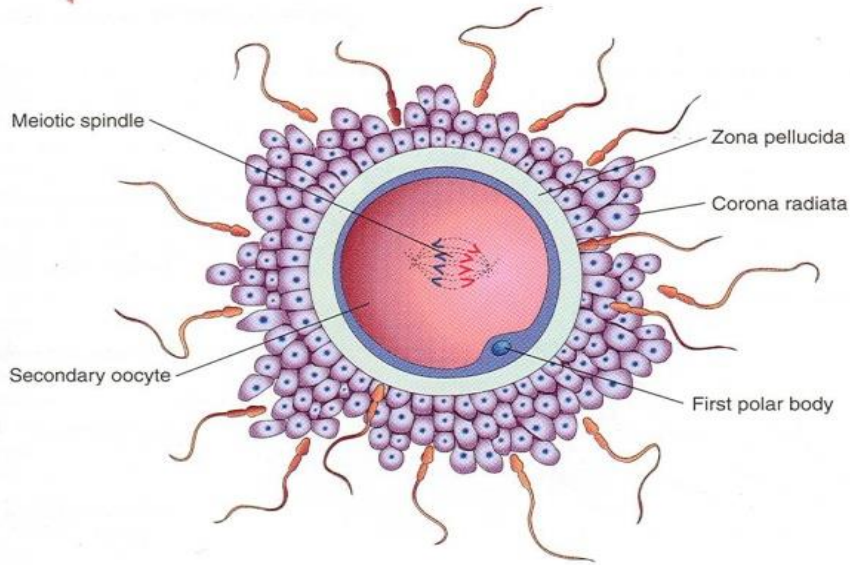
- After Puberty
- Shortly before ovulation, the **Primary Oocyte** completes its first meiotic division (which was arrested at prophase) and give rise to **Secondary oocyte** (23) & **First Polar Body**.
- The **Secondary Oocyte** receives almost all the cytoplasm.
- The **First Polar Body** receives very little amount of cytoplasm.
- It is small nonfunctional cell that soon degenerates.

OOGENESIS

- **At ovulation,** the nucleus of the secondary oocyte begins the **second meiotic division** but **progresses only to metaphase** where **division is arrested.**



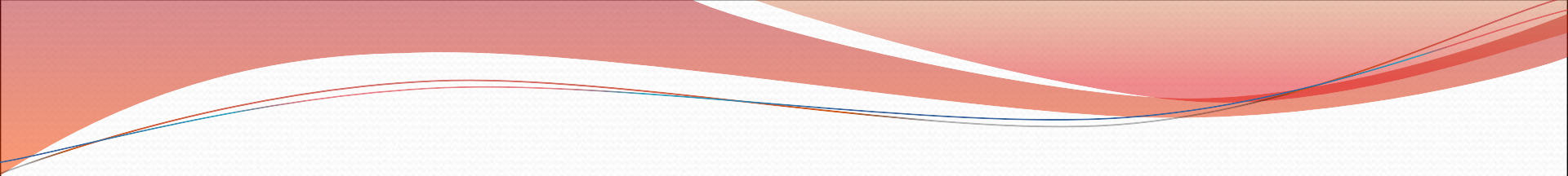
OOGENESIS



- If the **secondary oocyte** is **fertilized**, the second meiotic division is completed otherwise it degenerates 24 hours after ovulation.
- Most of the cytoplasm is retained by the **Mature Oocyte (Fertilized Oocyte)**.
- The rest is in the 2nd **Polar Body** which soon degenerates.

During Fetal Life	After puberty during each ovarian cycle	After fertilization
<p>Proliferation: Each oogonium is divided by mitosis into 2 daughter oogonium with diploid number of chromosome, (44+XX)</p>	<p>1st meiotic division is completed shortly before ovulation</p>	<p>2nd meiotic division is completed as the sperm penetrates the zona pellucida.</p>
<p>Growth: Oogonia enlarge to form primary oocyte with diploid number of chromosomes, (44+XX).</p>	<p>A reduction division by which the primary oocyte divided into 2ry oocyte (haploid number of chromosome 22+x, and first polar body which degenerates.</p>	<p>The secondary oocyte divides into mature ovum and 2nd polar body which degenerates.</p>
<p>Primary oocyte begins its 1st meiotic division with arrest at prophase.</p>	<p>2nd meiotic division begins: at ovulation but stops at metaphase.</p>	

NB. NO PRIMARY OOCYTES ARE FORMED AFTER BIRTH



GOOD LUCK