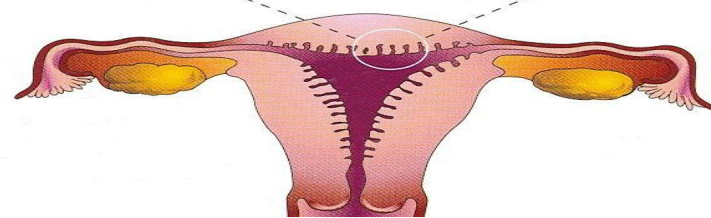
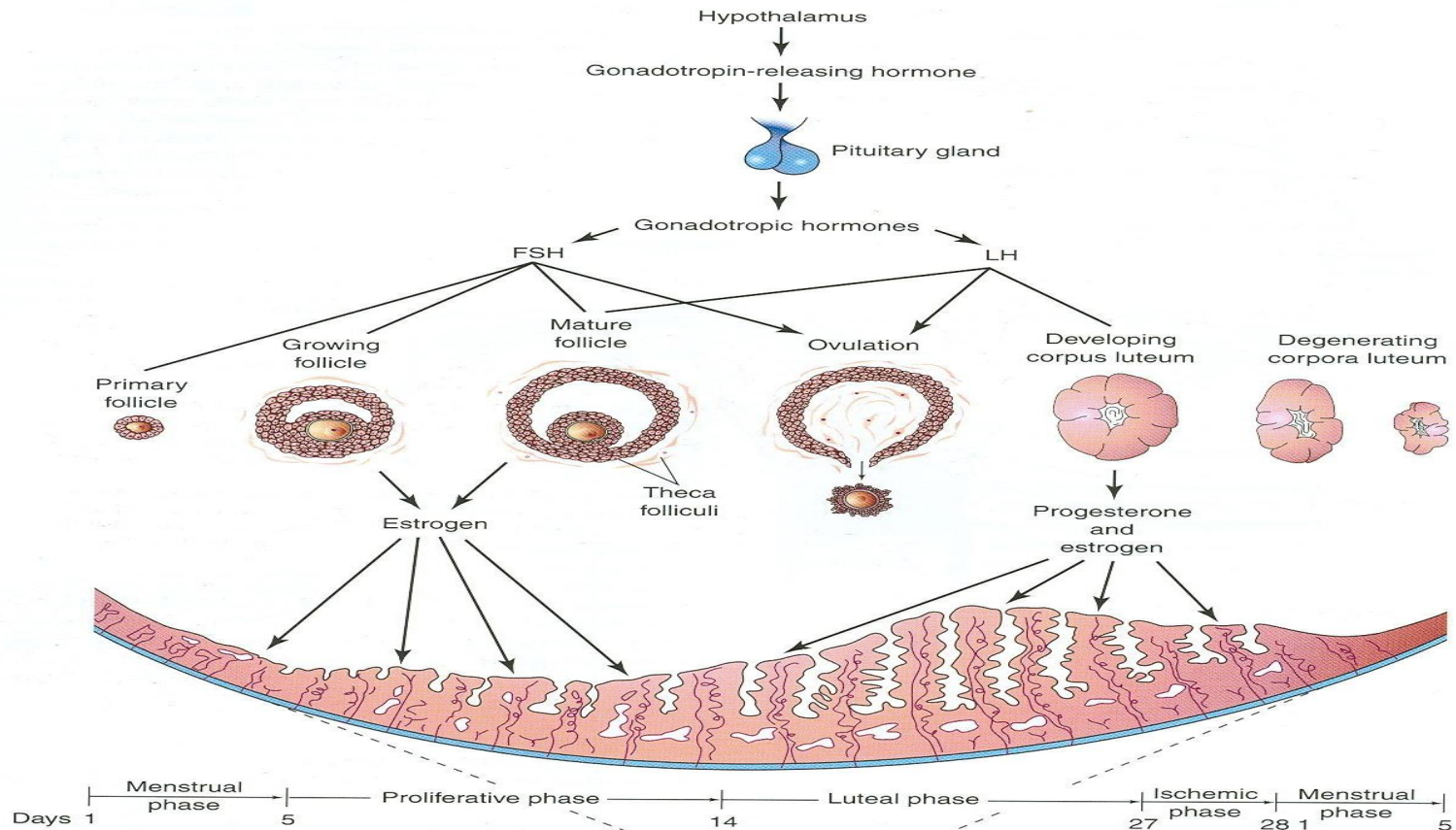


GAMETOGENESIS & FEMALE CYCLES



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OBJECTIVES

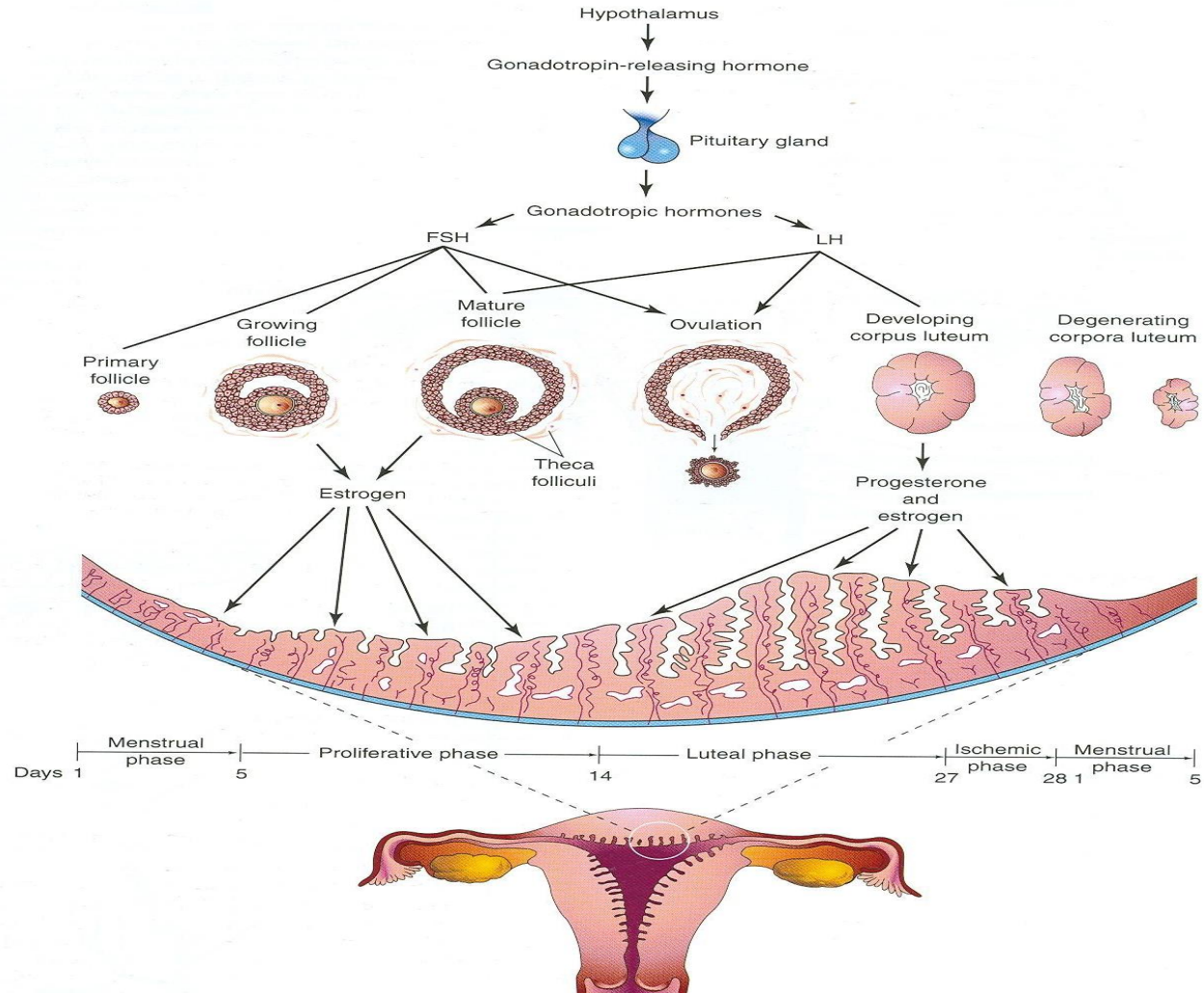
- *By the end of the lecture, you should be able to:*
- Describe the female cycles (**Ovarian & Uterine**).
- Define **gametogenesis**.
- Differentiate the types of **gametogenesis**.
- Describe the process of **spermatogenesis**.
- Describe the process of **oogenesis**.

Female Reproductive Cycles

OVARIAN AND UTERINE CYCLES

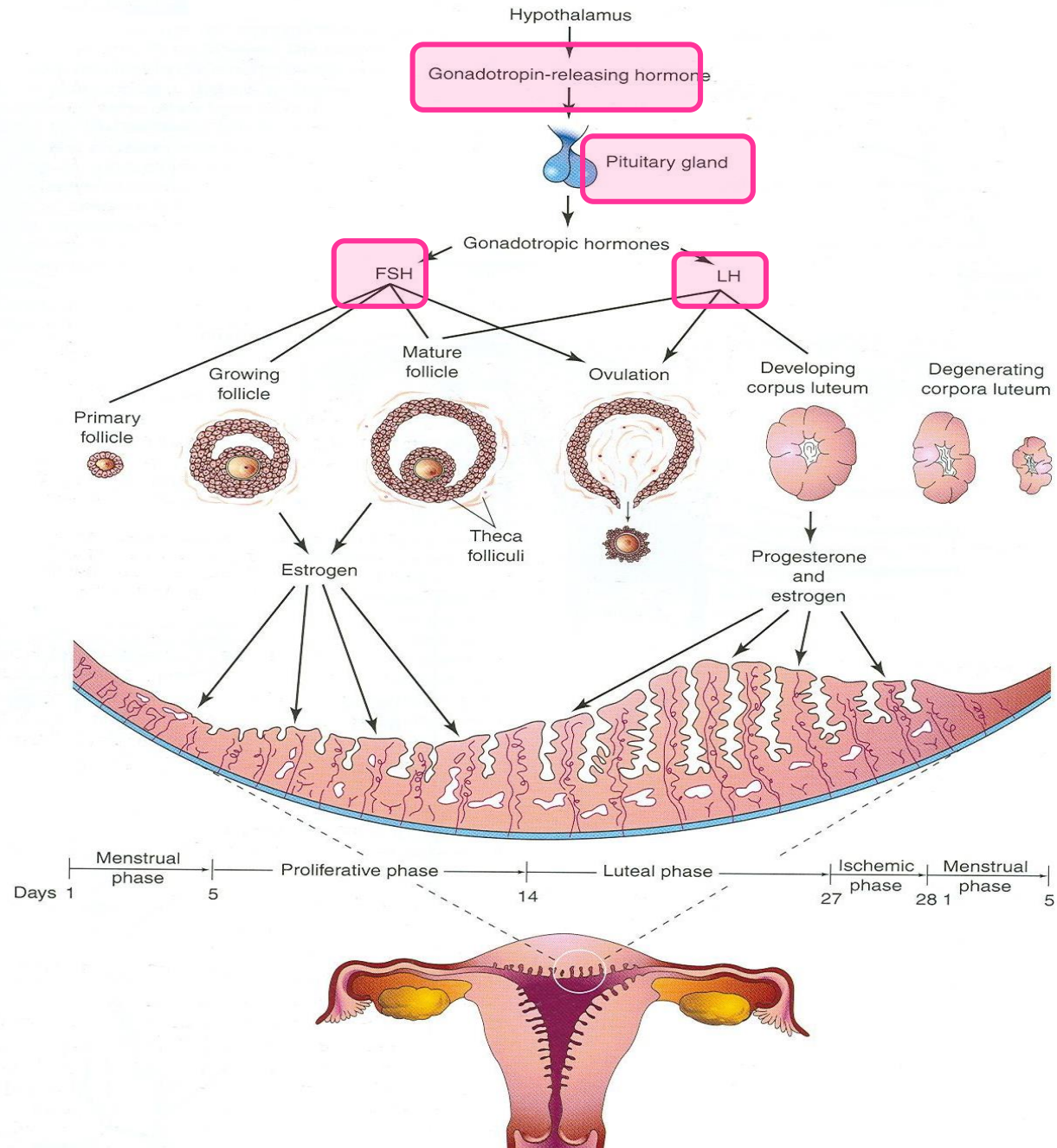
- **Start** at puberty.
- Normally continues until the **menopause**.
- These Reproductive cycles depend upon activities & coordination of:

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

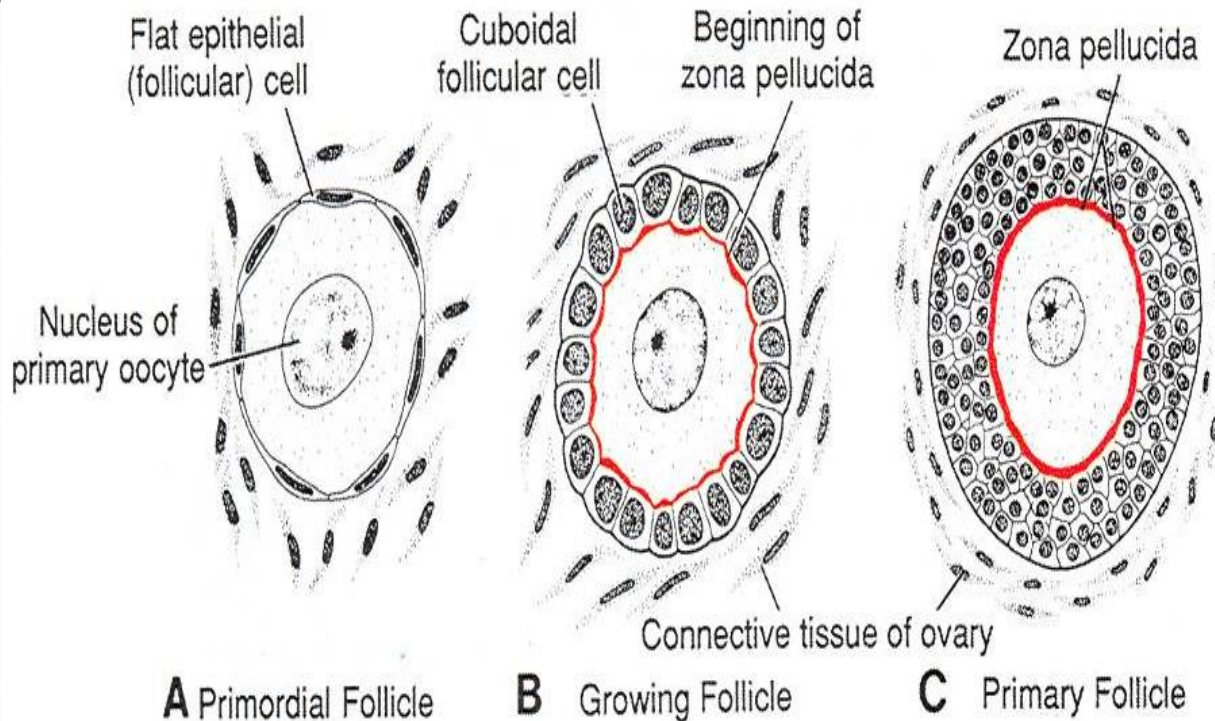


GnRH

- **Gonadotrophin-releasing hormone (GnRH)** is synthesized by neurosecretory cells in 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



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

Follicular Phase

FH

Early development of ovarian follicle is induced by FSH.

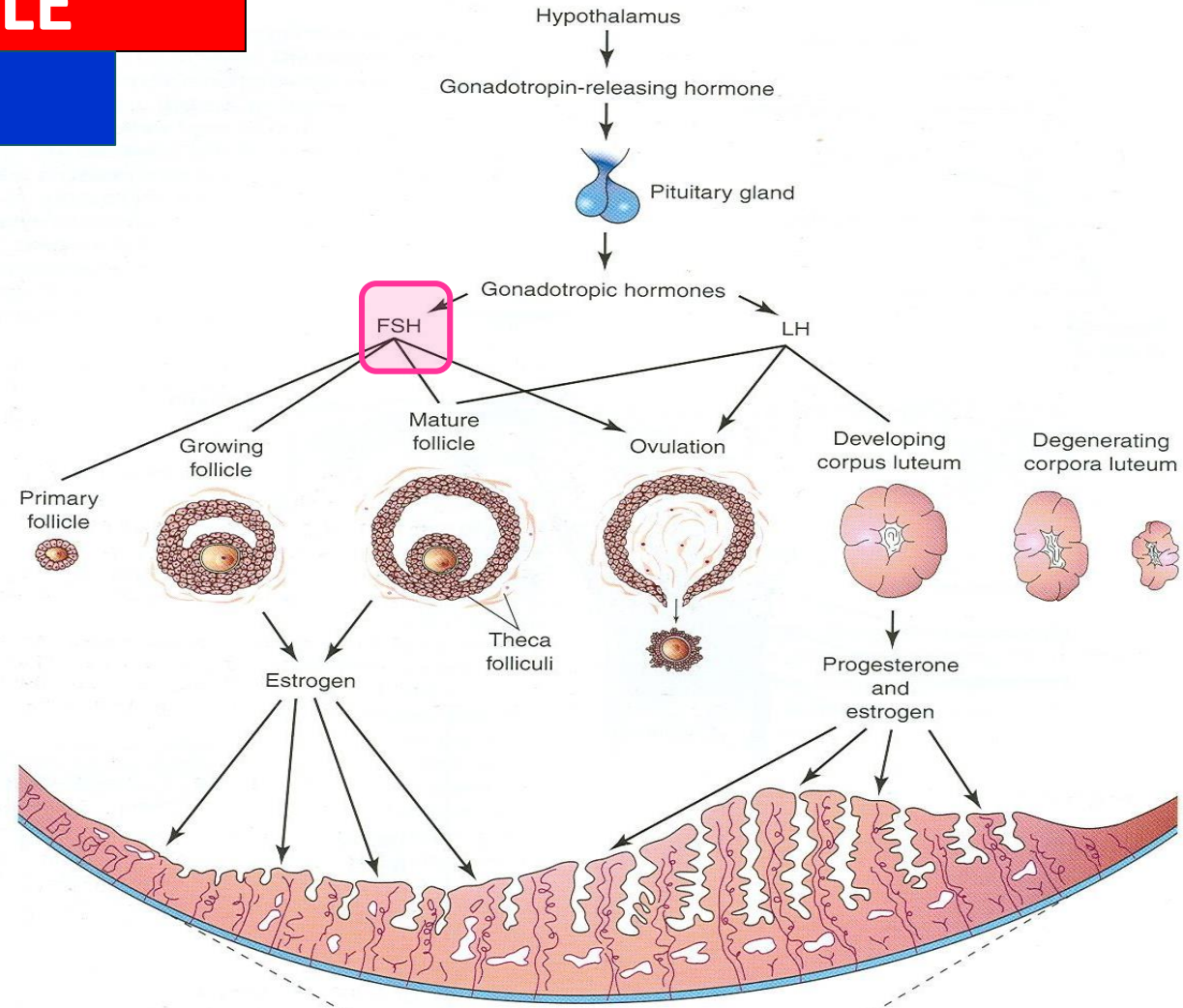
The simple flat follicular cells become cuboidal, then columnar then forming many layers around the oocyte forming primary ovarian follicle.

OVARIAN CYCLE

Follicular Phase

FSH

- **FUNCTIONS:**
- 1- It stimulates the development of ovarian primary follicles and to become mature.
- 2- Production of Estrogen by the follicular cells.

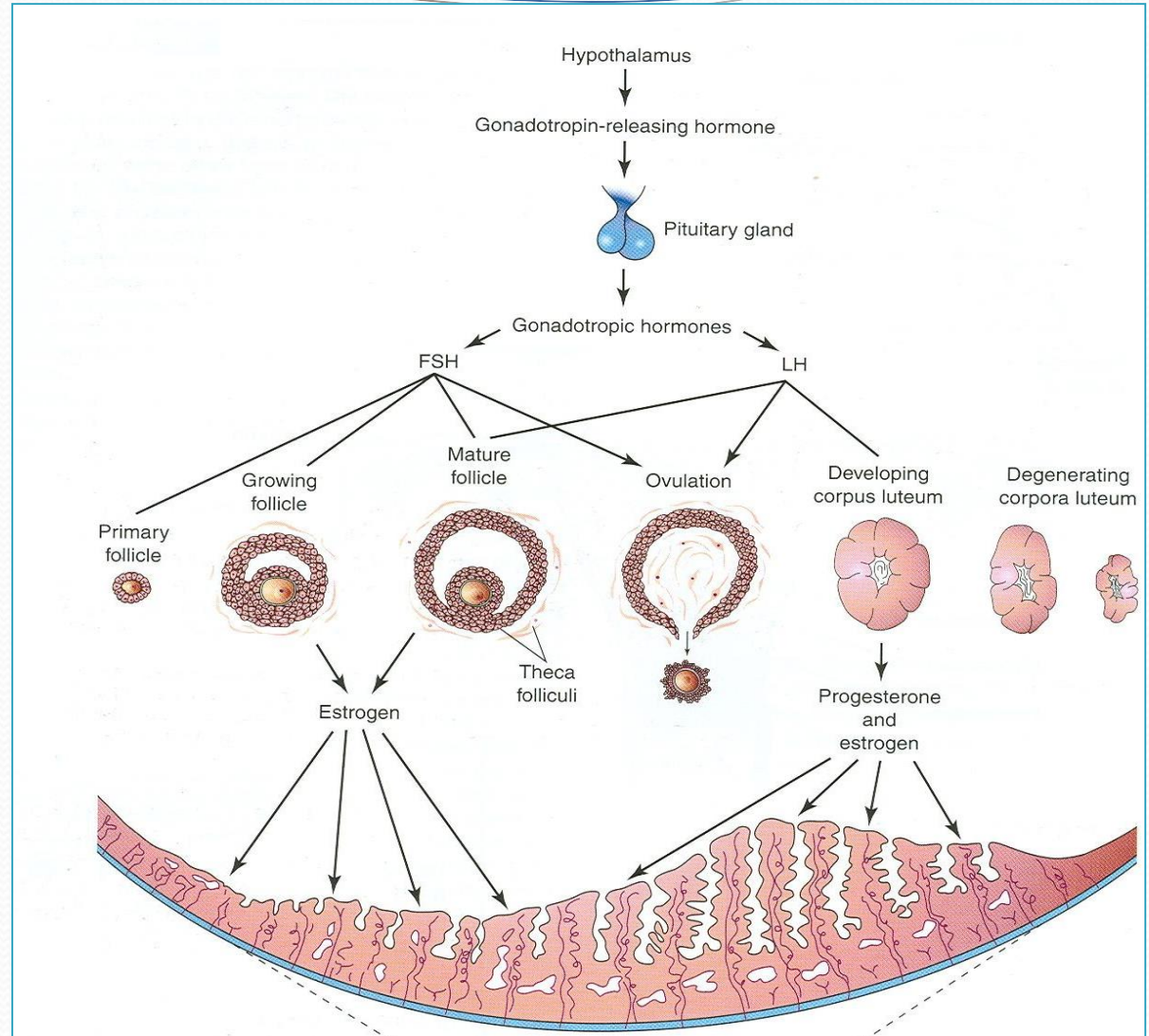


These Growing follicles produce estrogen which regulates the development and functions of the reproductive organs as breast & endometrium.

Ovulatory Phase

LH

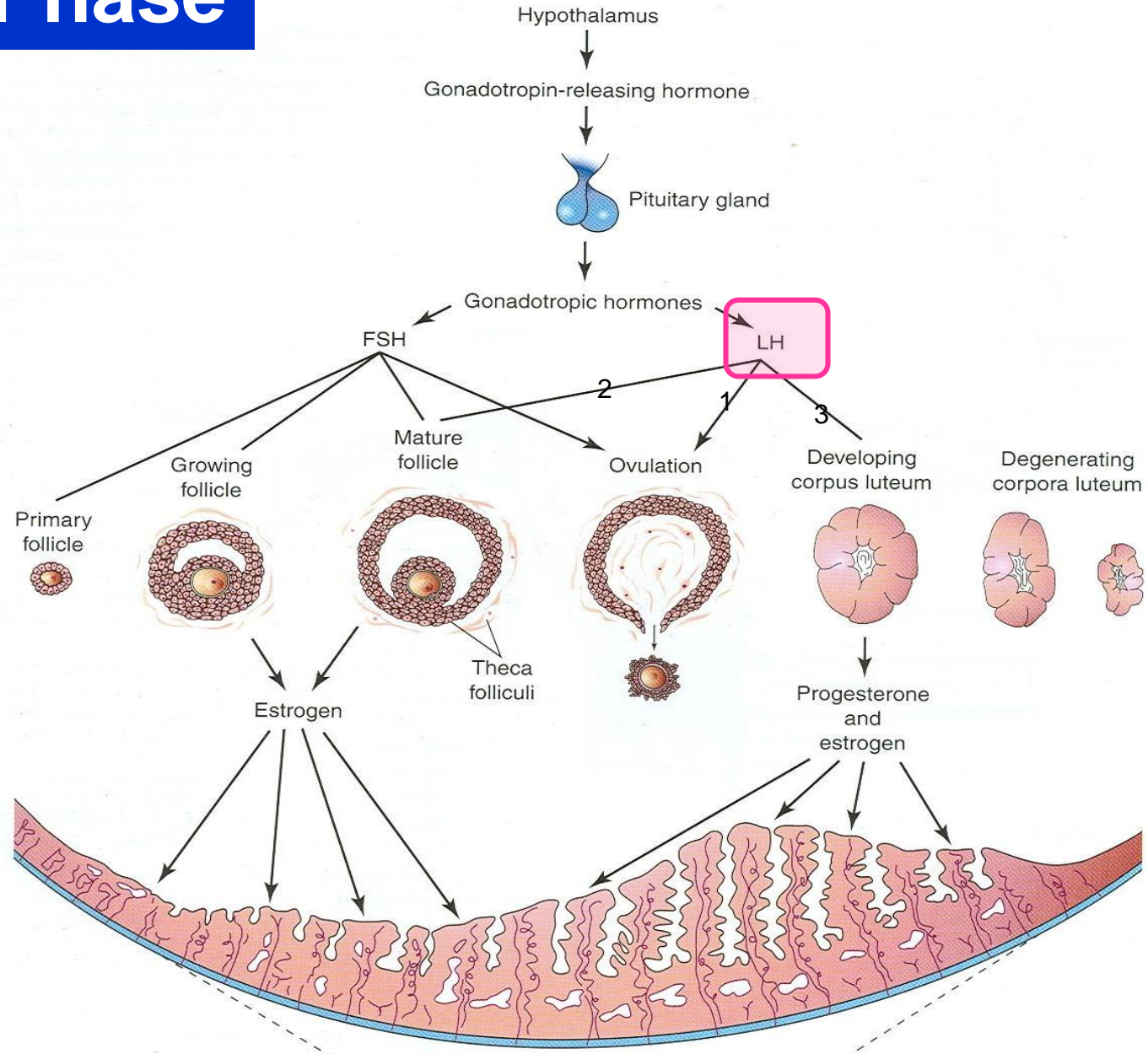
- The **follicle** becomes **enlarged** until it gets **maturity**.
- **Early development** of **ovarian follicle** is **induced by FSH**.
- **Final stages** of **maturation** **require LH**.
- **LH** causes **ovulation** (rupture of the mature follicle).



Ovulatory Phase

LH

- Luteinizing Hormone.
- **FUNCTIONS:**
- 1- It serves as the **trigger for ovulation.**
- 2- Stimulates the **mature follicles** to produce **Estrogen.**
- 3- Stimulates **corpus luteum** to produce **Progesterone.**



Luteal Phase

- The **remaining** of the **ruptured follicle** is now called **corpus luteum**.

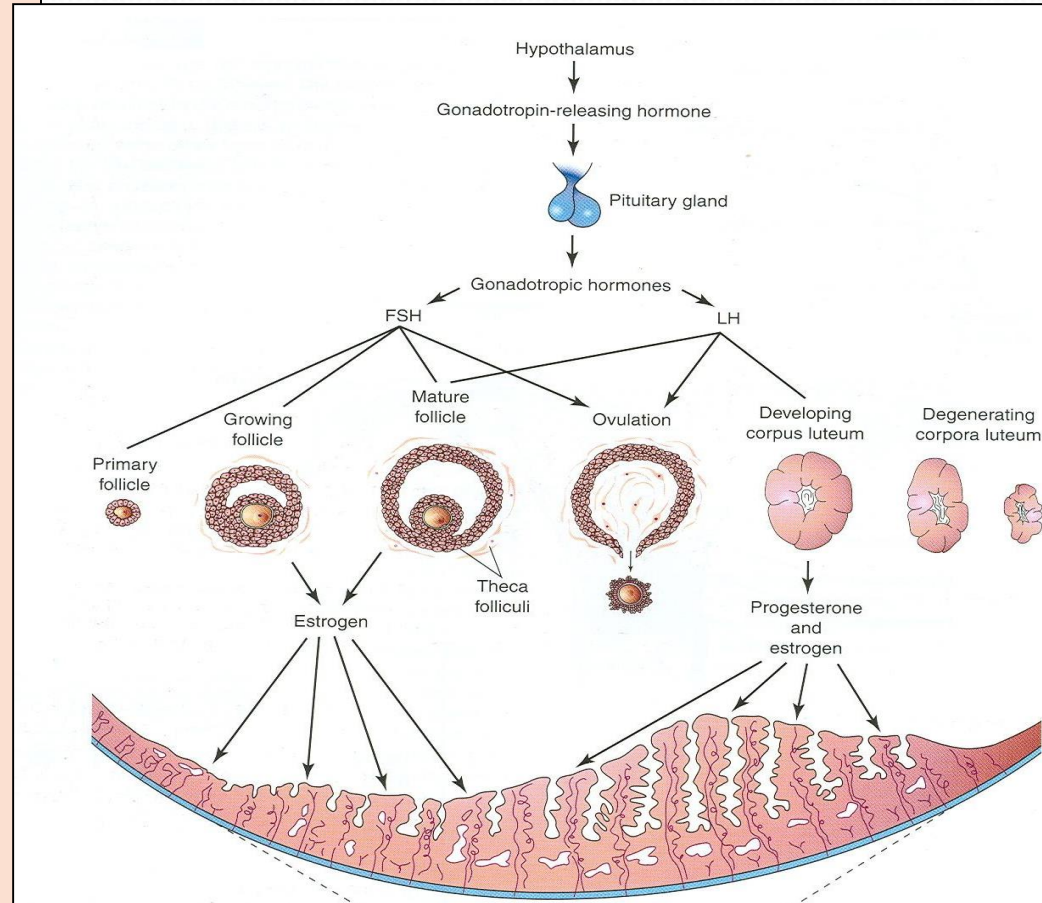
- It secretes **Progesterone** and **small amount** of **Estrogen**.

- These **2 hormones stimulate and prepare endometrium** for **implantation** of fertilized Ovum (Blastocyst).

- If the **oocyte** is **fertilized**; the **Corpus Luteum** enlarges and **remains** till the **4th month** of pregnancy.

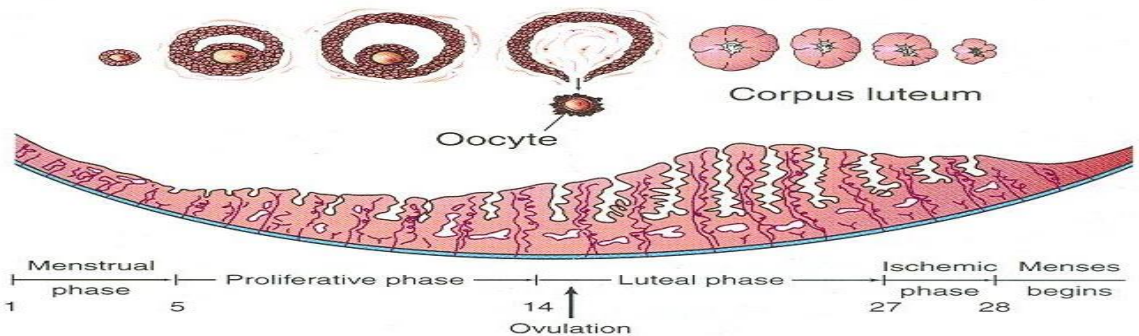
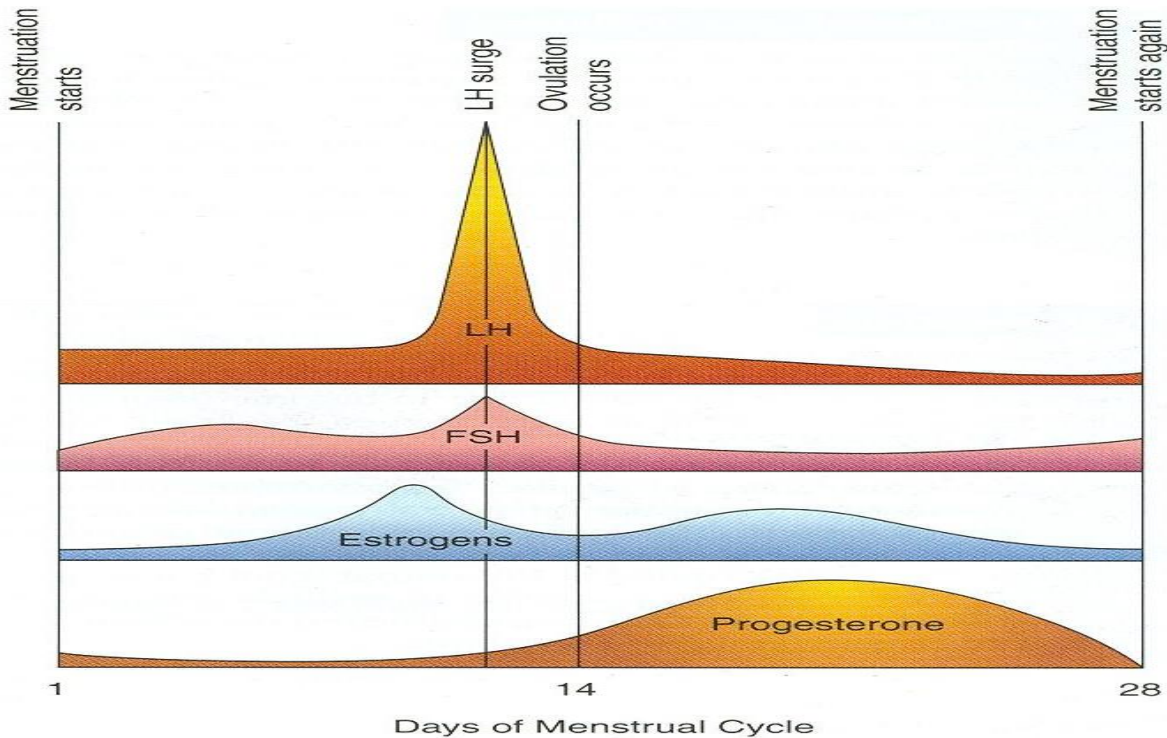
- If the **oocyte** is **not fertilized** the corpus luteum involutes and **degenerates** in **10-12** days.

& Corpus Luteum formation



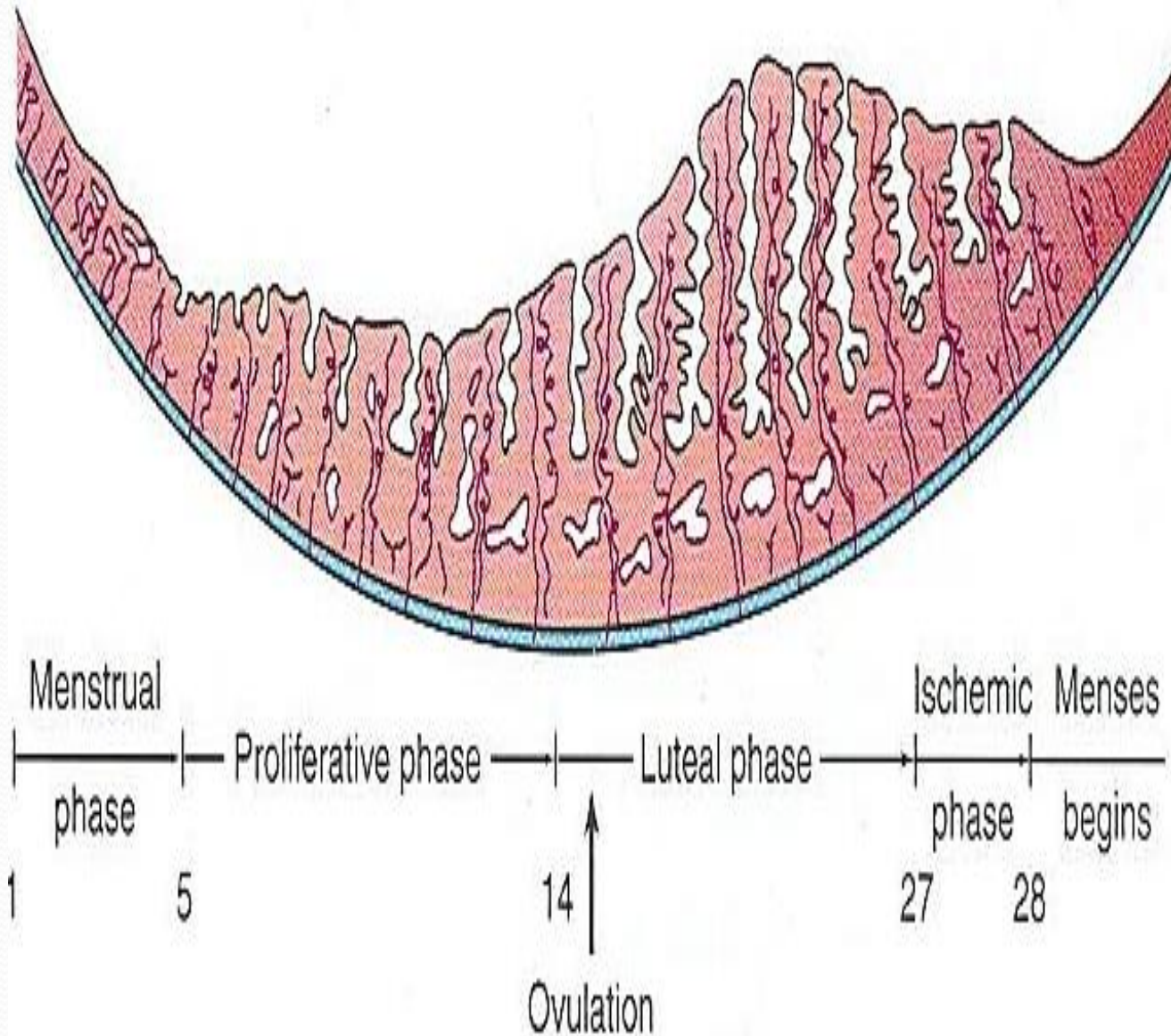
Uterine or Menstrual Cycle

- Cyclic changes in the endometrium of the uterus caused by **estrogen & progesterone**.
- Average menstrual cycle is 28 days.
- **Day One** is the day of beginning of **menstrual blood flow**.
- 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.



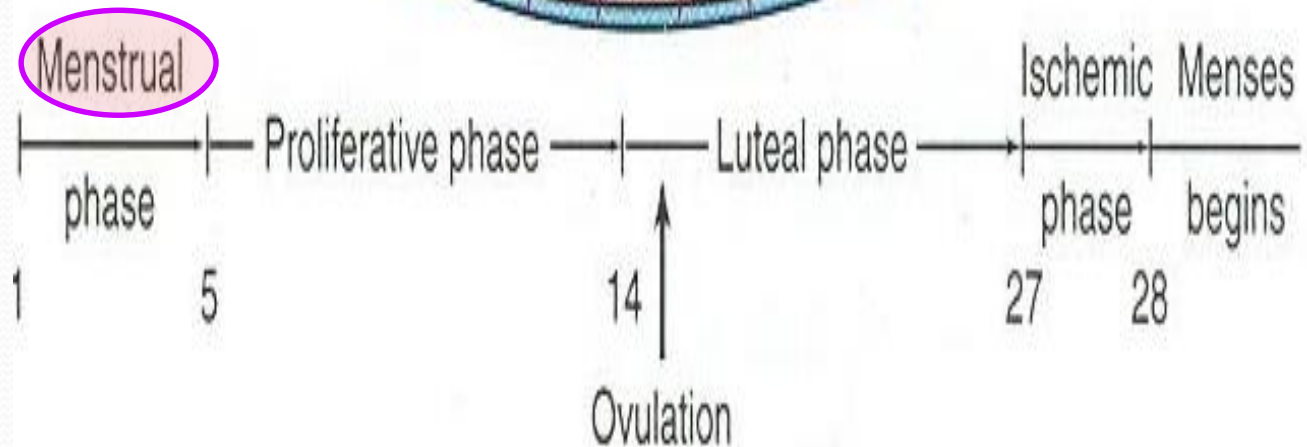
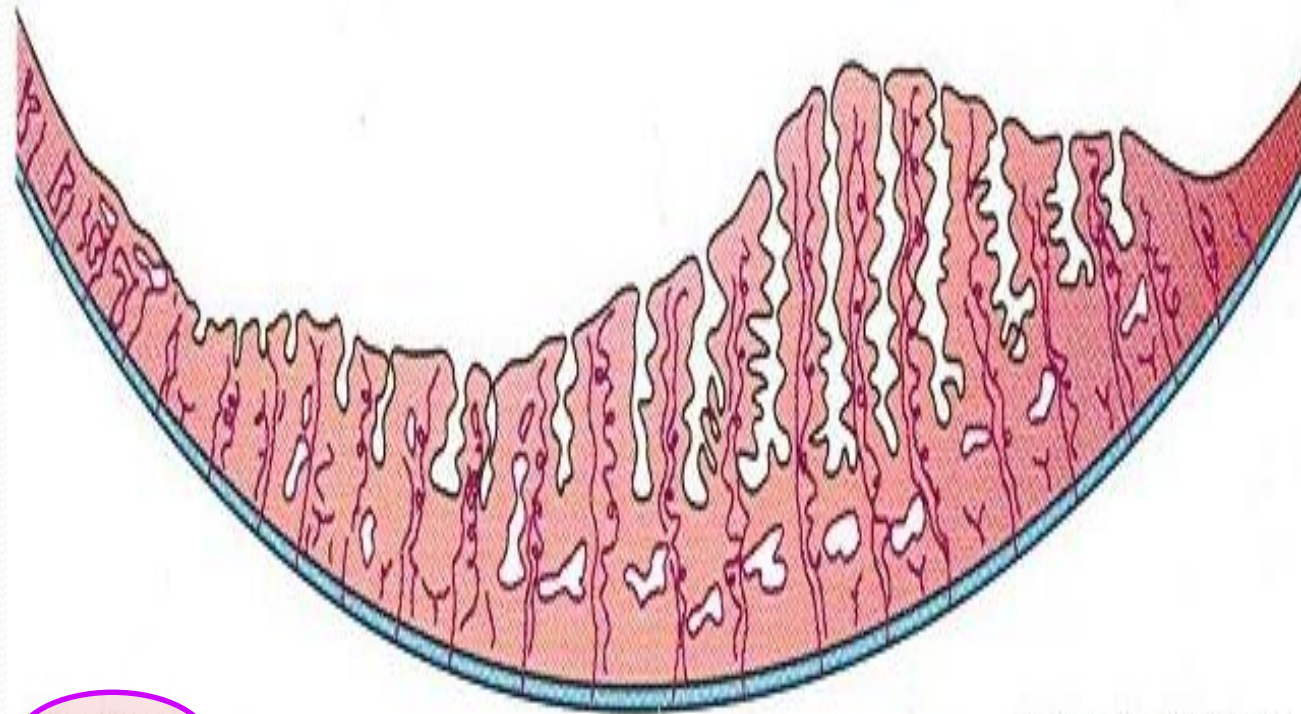
Phases of Menstrual Cycle

1. **Menstrual Phase**
2. **Proliferative or Follicular Phase**
3. **Luteal Phase**
4. **Ischemic Phase**



Menstrual Phase

- Starts with 1st day of menstrual cycle.
- Lasts for 4-5 days.
- **Functional layer of the endometrium is sloughed off and discarded with the menstrual flow.**
- **So; Blood discharge from vagina is combined with small pieces of endometrial tissue.**



- Is a phase of repair and proliferation.

- Lasts for 9 days.

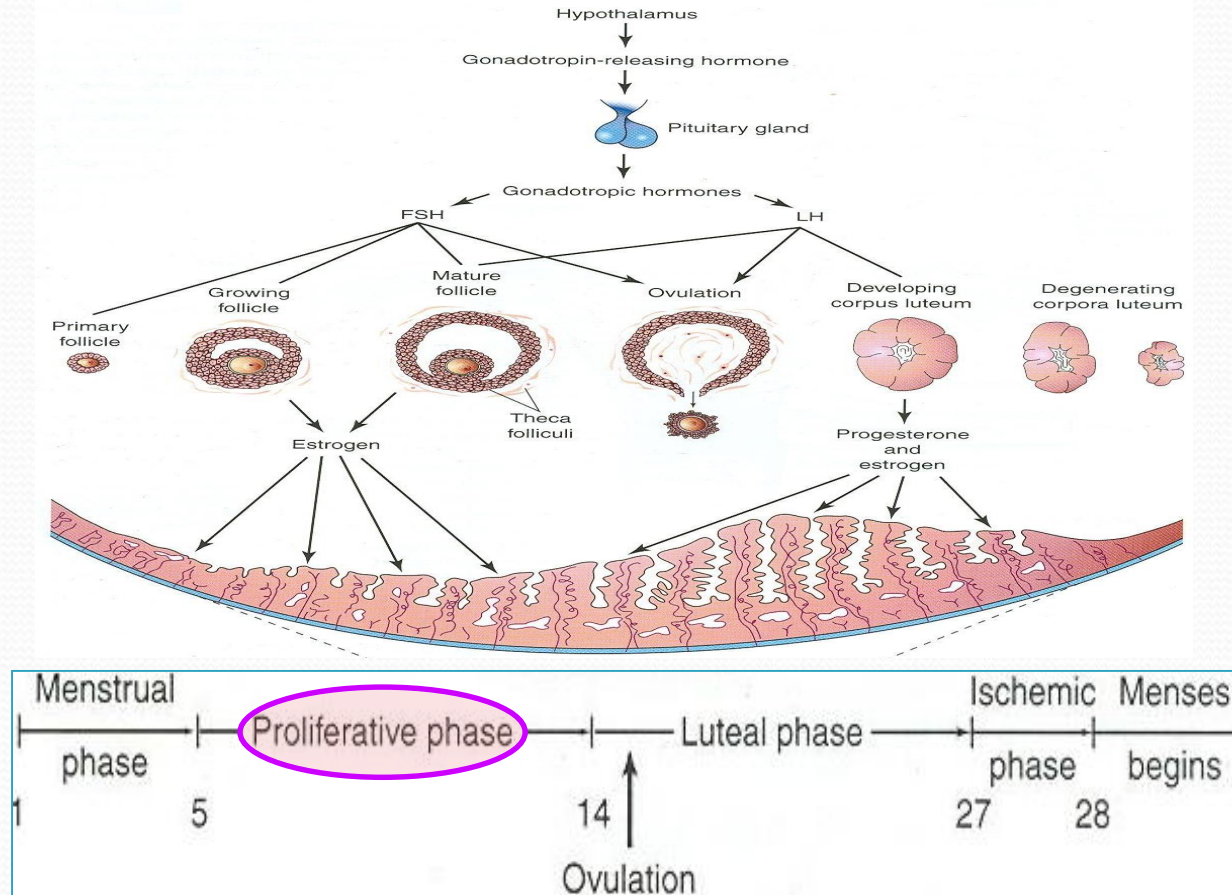
- Coincides with growth of ovarian follicle (Follicular Phase).

- So it is controlled by Estrogen secreted by the follicular cells.

- Thickness of the endometrium is increased into 2-3 folds.

- The glands increase in number and length and the spiral arteries elongate.

Proliferative Phase



Luteal Phase

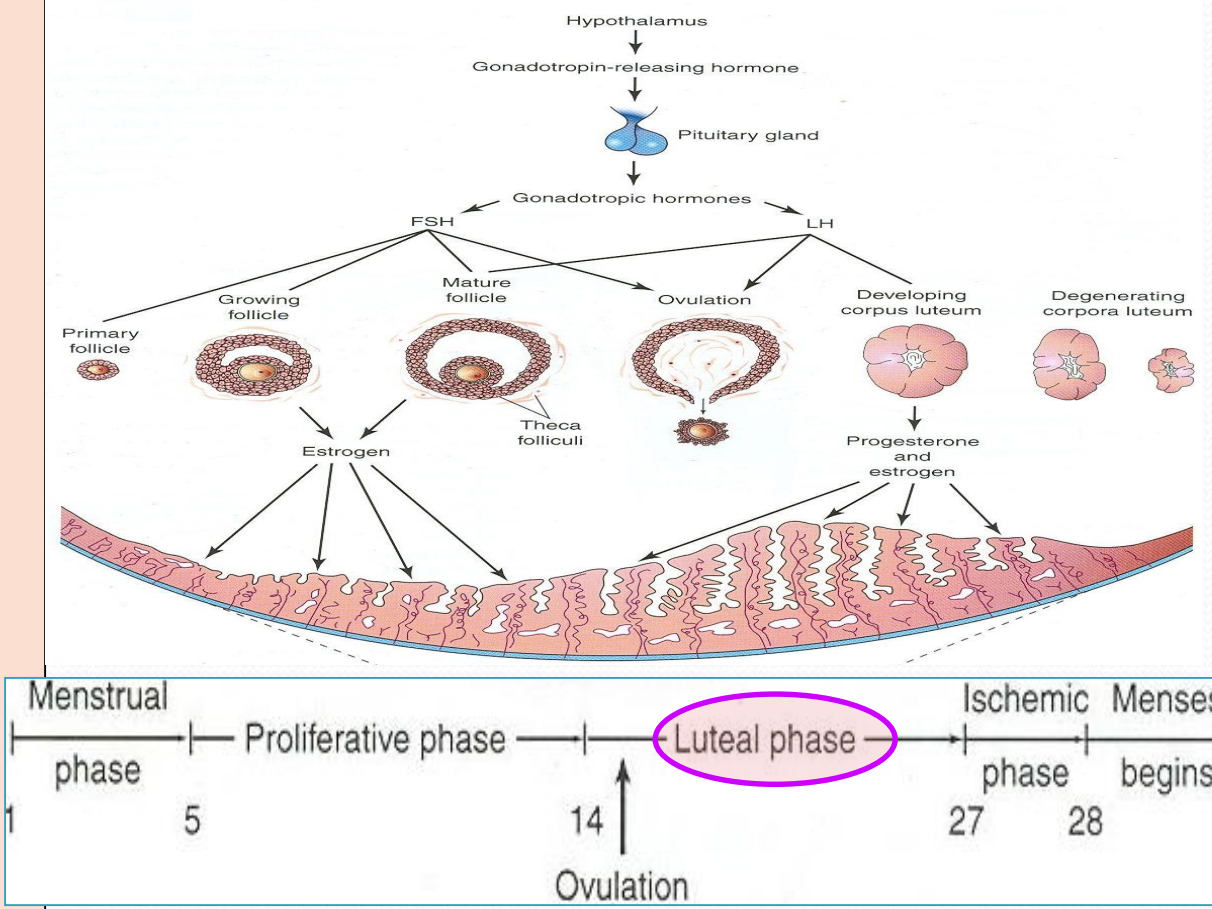
- Is a **Secretory or Progesterone phase.**

- Lasts about 13 days.

- Coincides with the formation, growth and functioning of the **Corpus Luteum (Luteal phase of ovarian cycle).**

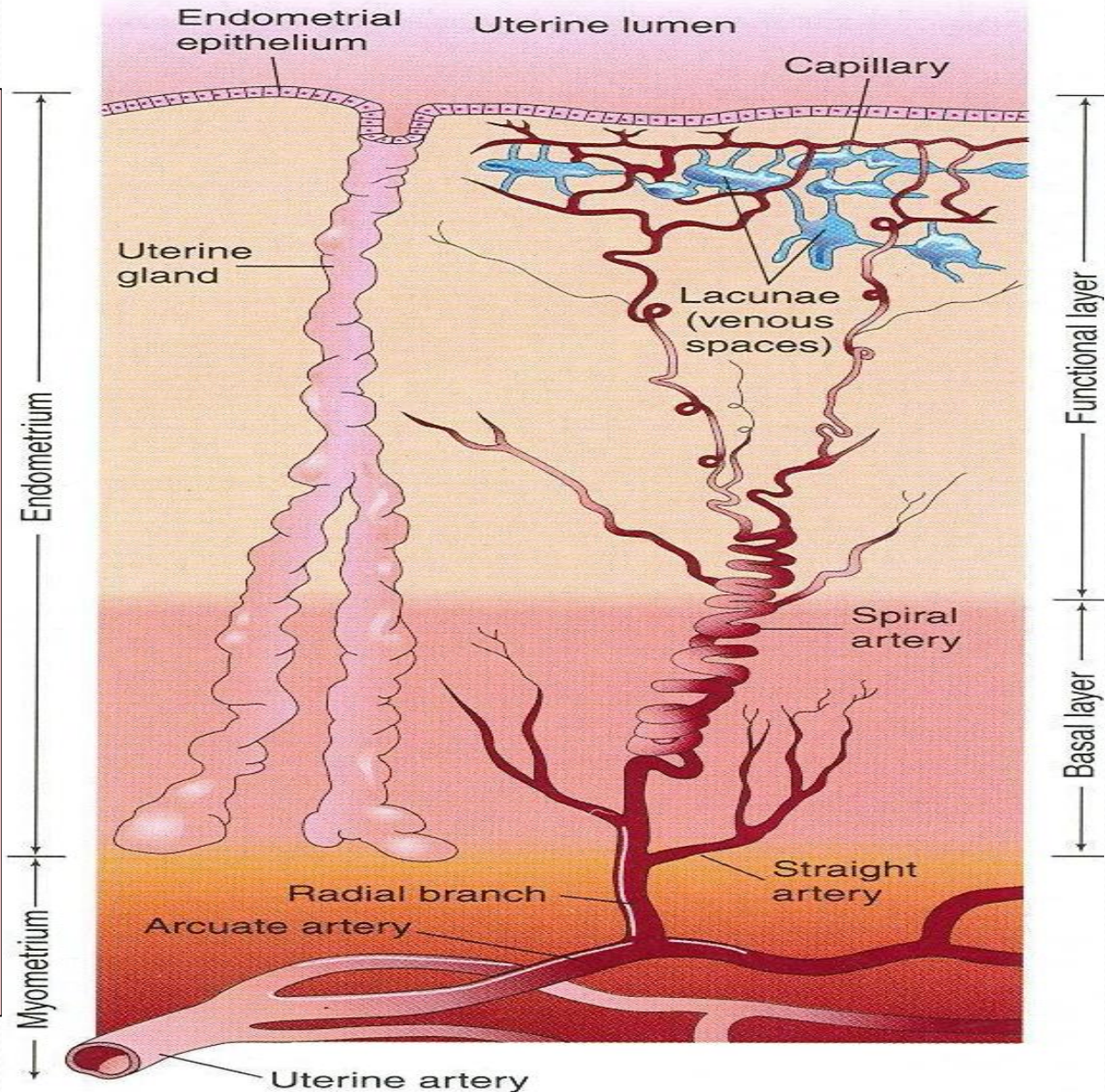
- **Glandular epithelium secretes glycogen rich material.**

- **Endometrium thickens under the influence of estrogen and progesterone.**



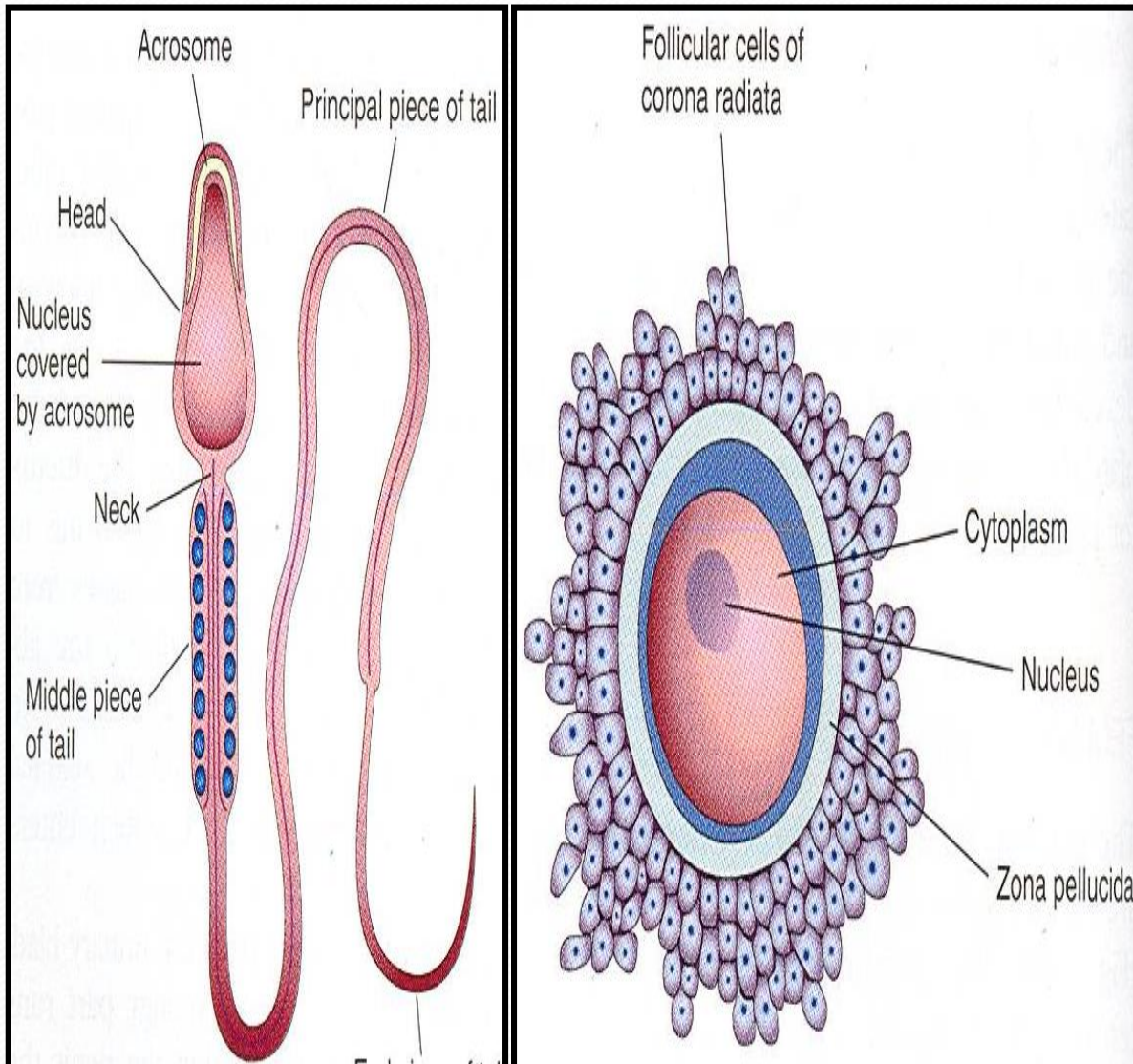
Luteal Phase

- **Spiral arteries** grow into the superficial layer.
- **Arteries** become increasingly coiled.
- **Large venous network** develops.
- **Direct arterio-venous anastomoses** are the prominent features.



GAMETOGENESIS

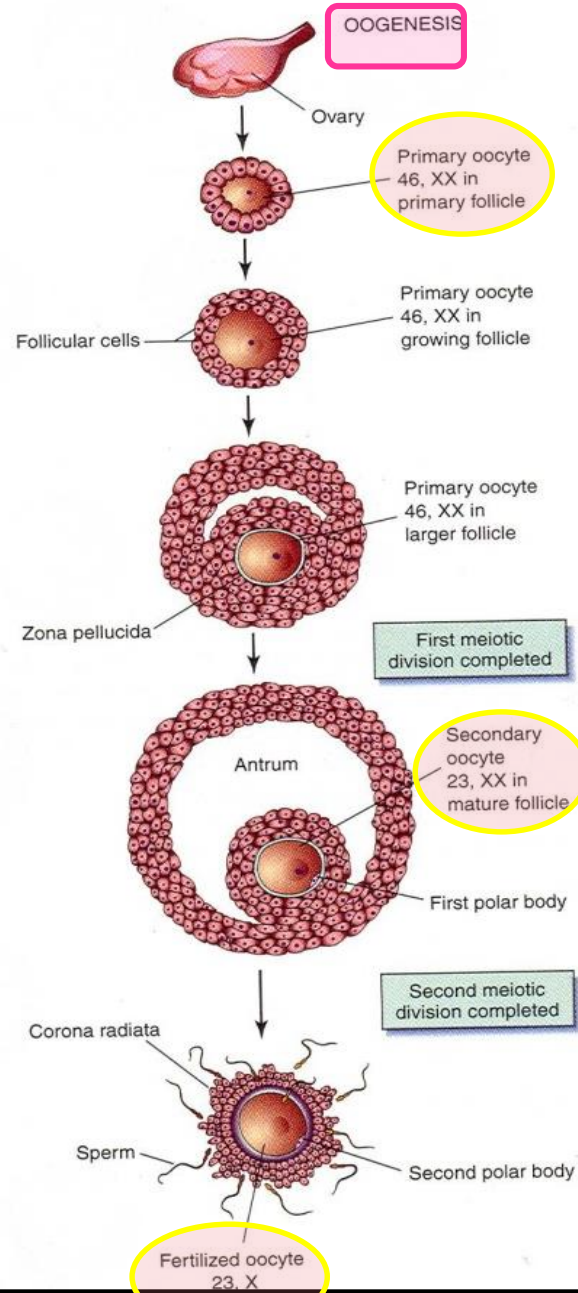
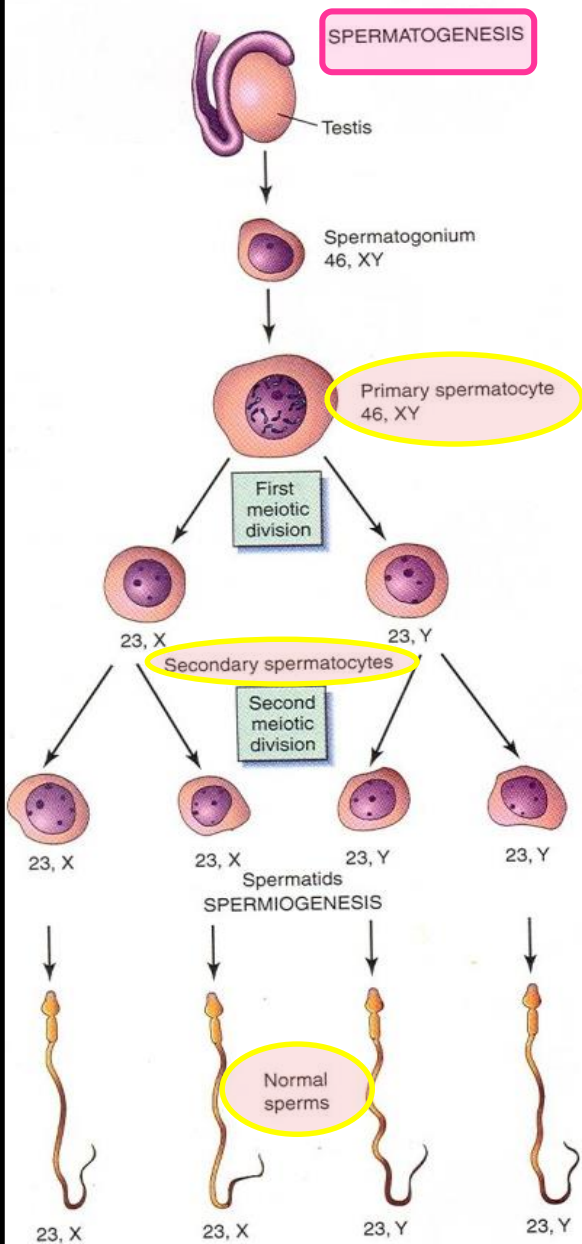
(Gamete Formation)



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.**

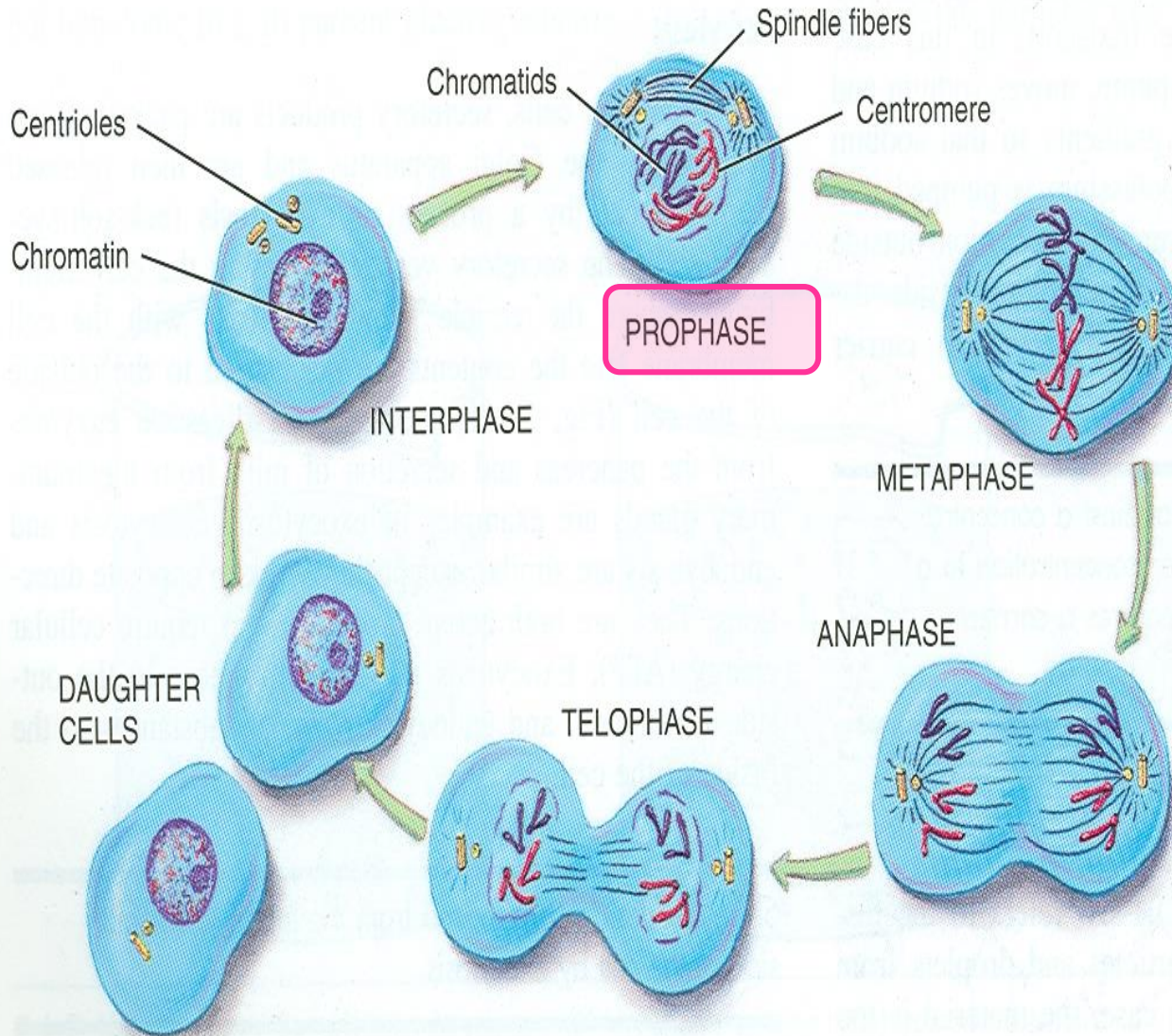
NORMAL GAMETOGENESIS



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**).

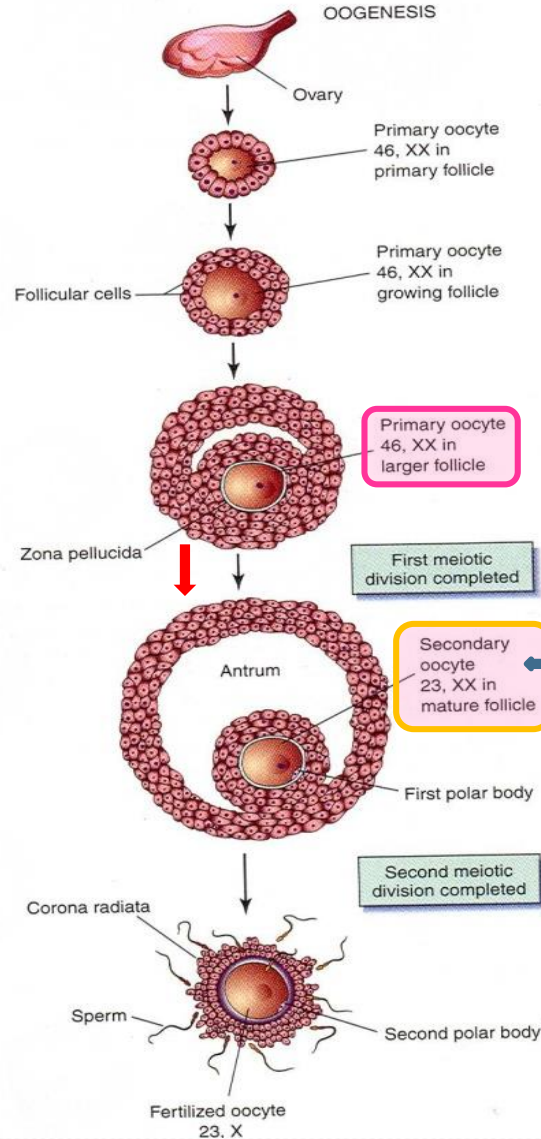
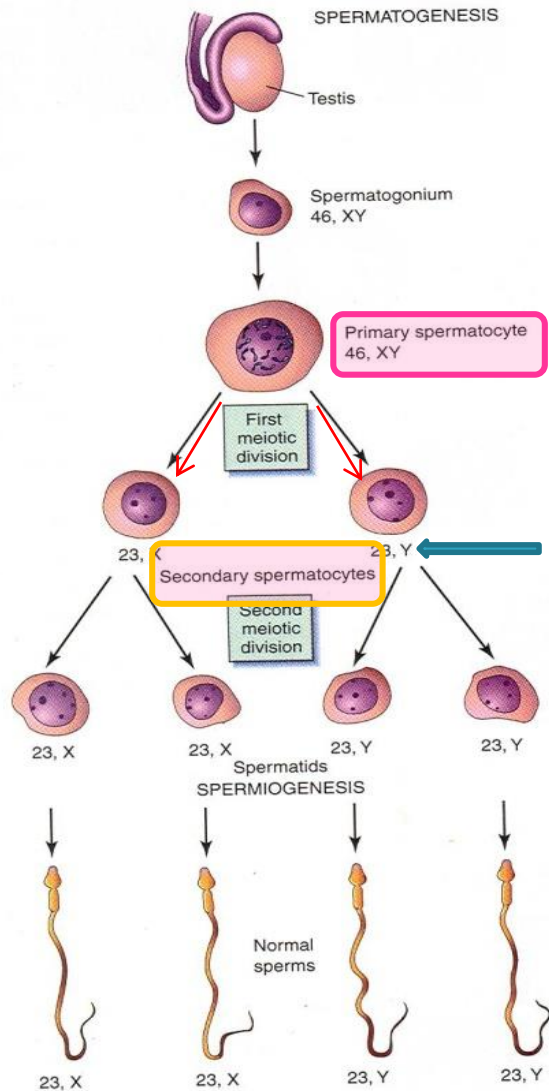
FIRST MEIOTIC DIVISION



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

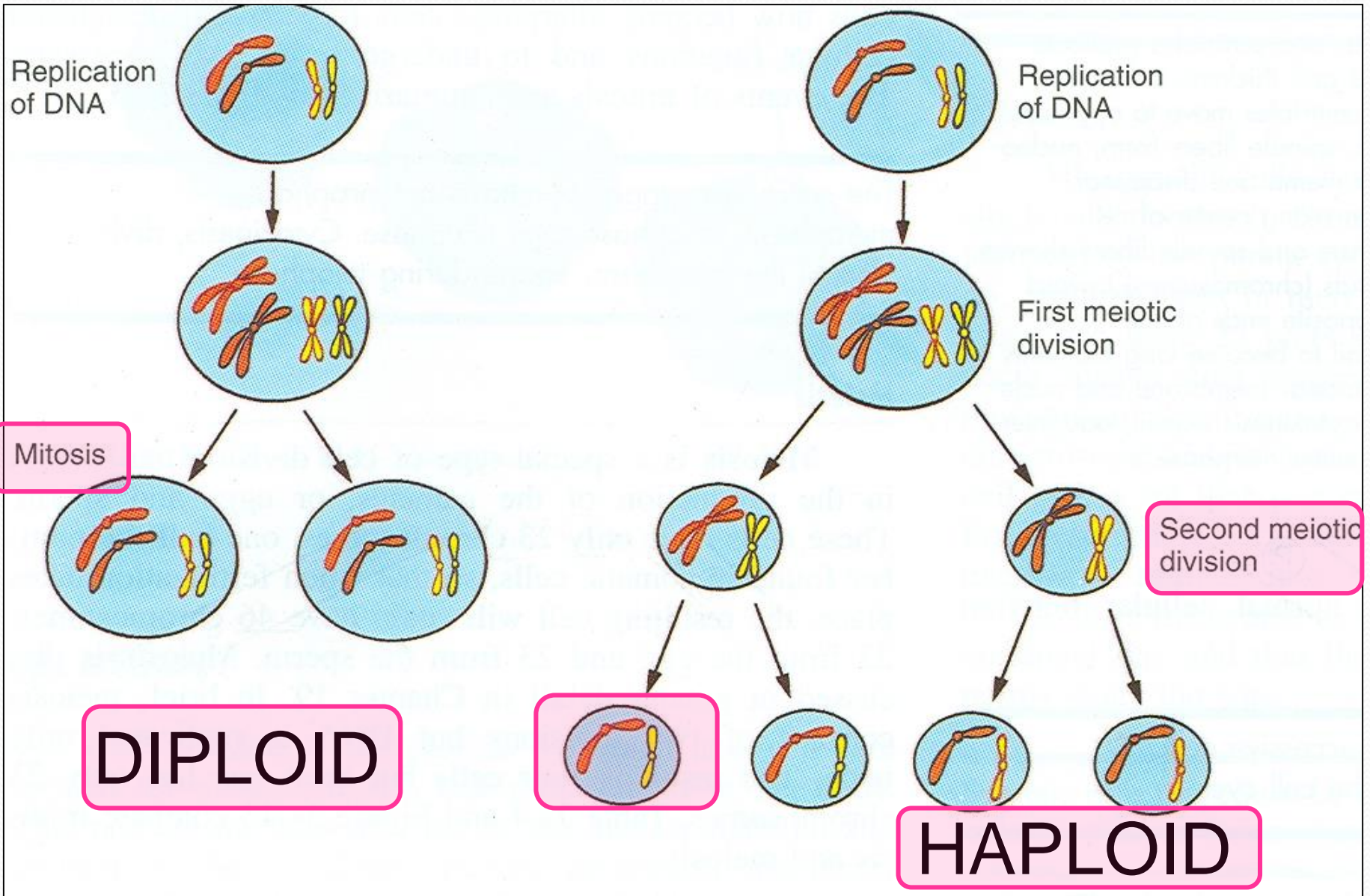
FIRST MEIOTIC DIVISION

NORMAL GAMETOGENESIS

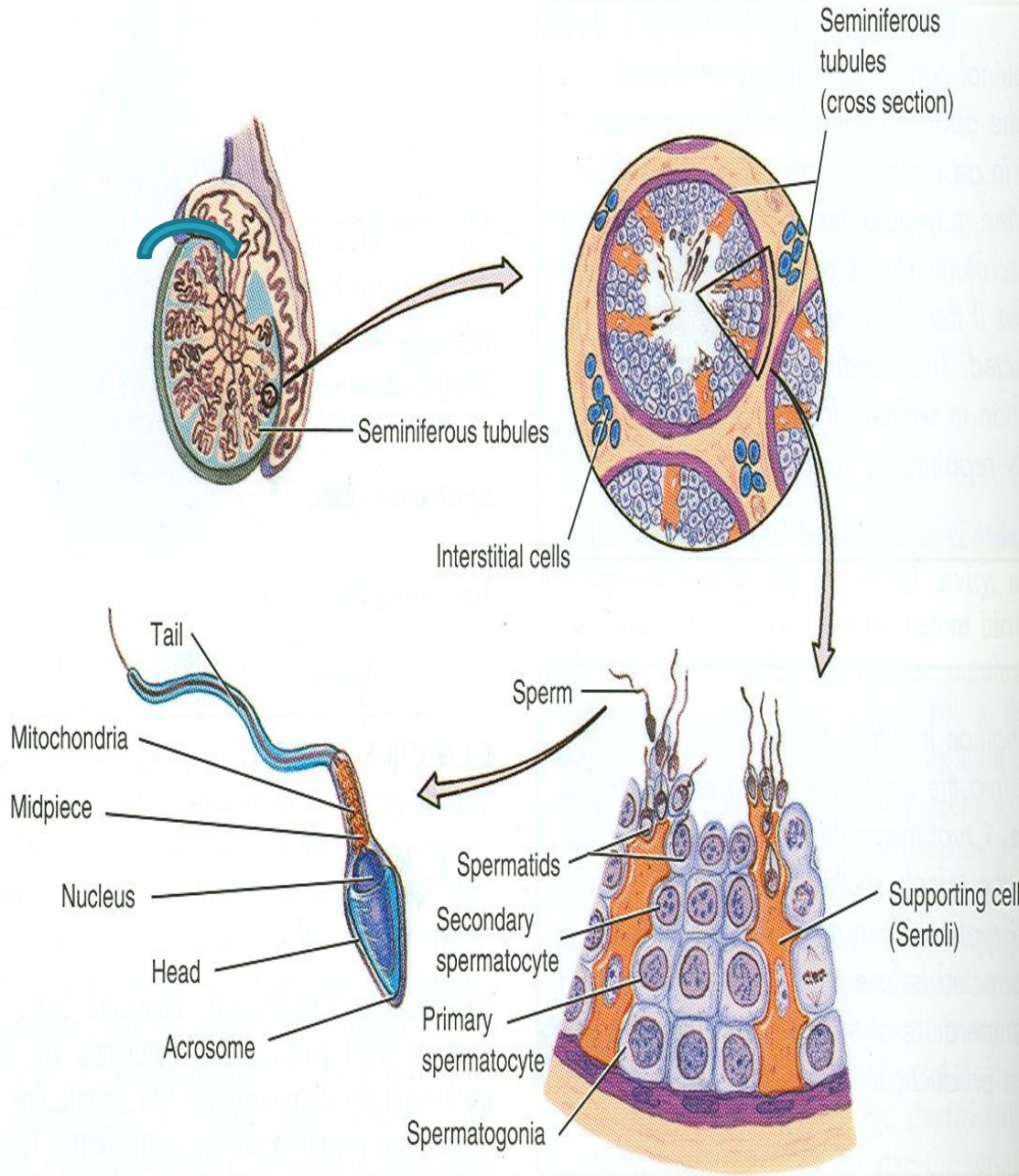


- By the end of the 1st meiotic division, each new cell formed (**Secondary Spermatocyte or Secondary Oocyte**) has haploid (half) number of chromosome.
- It is 1/2 number of chromosomes of the **Primary Spermatocyte or primary Oocyte**.

WHAT IS THE DIFFERENCE BETWEEN MITOSIS & MEIOSIS?



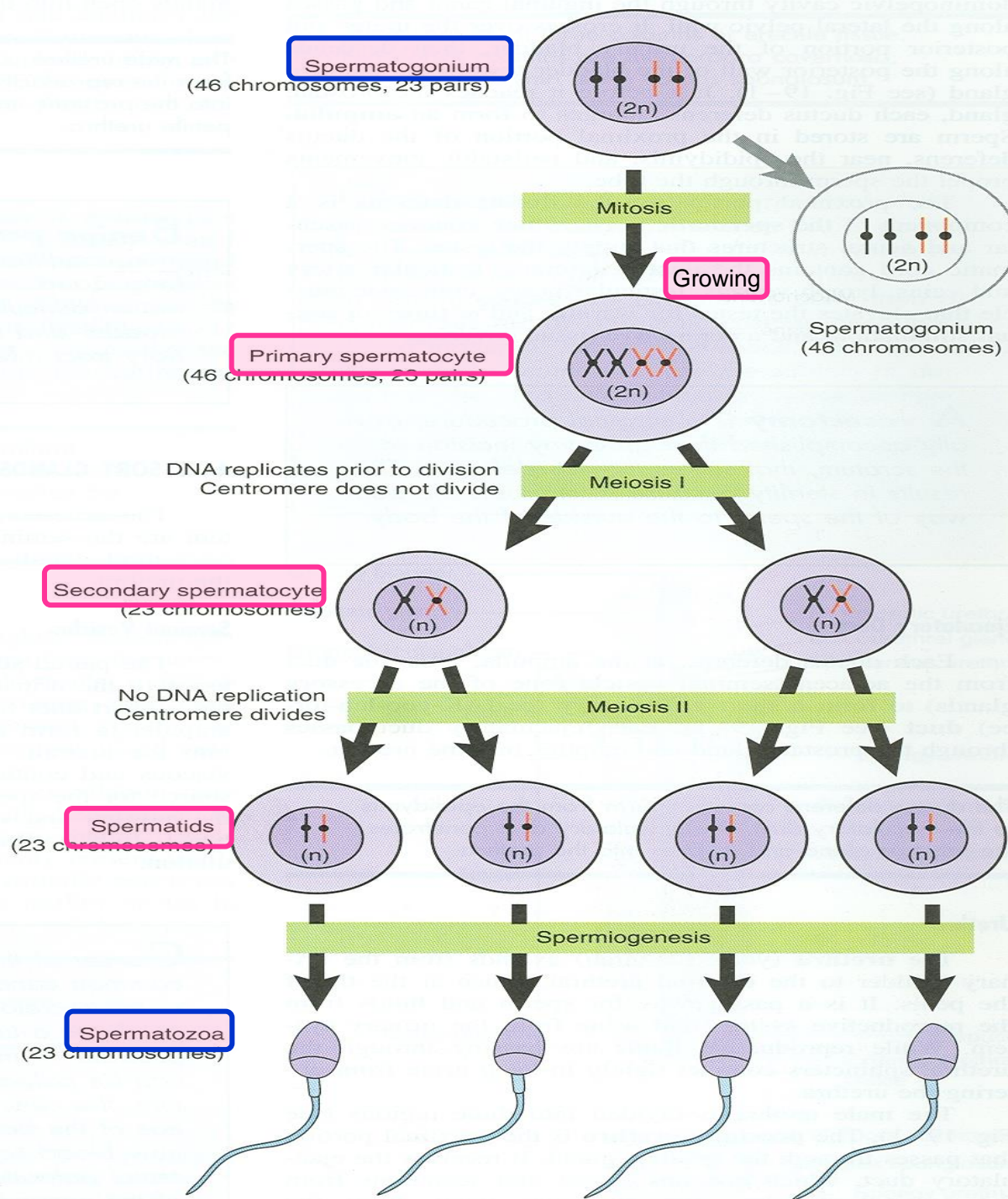
SPERMATOGENESIS



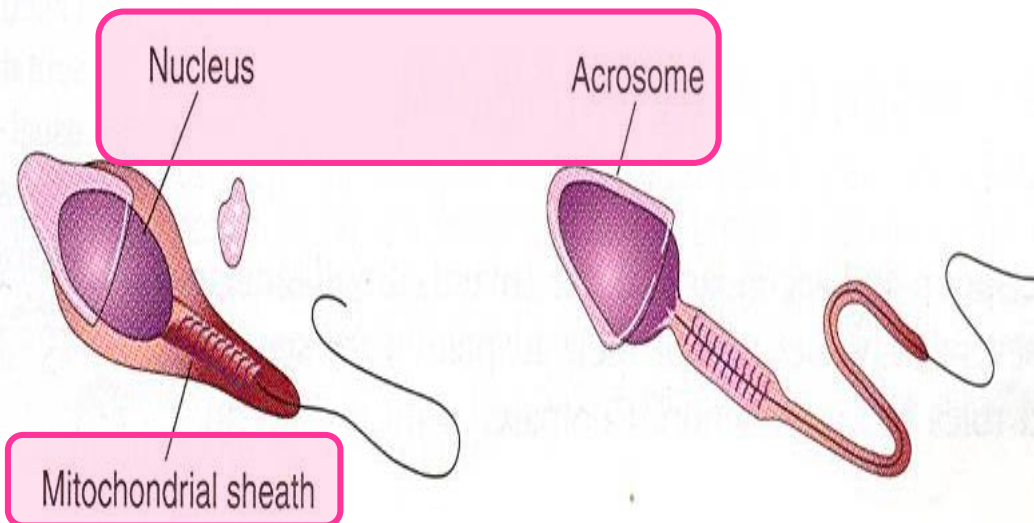
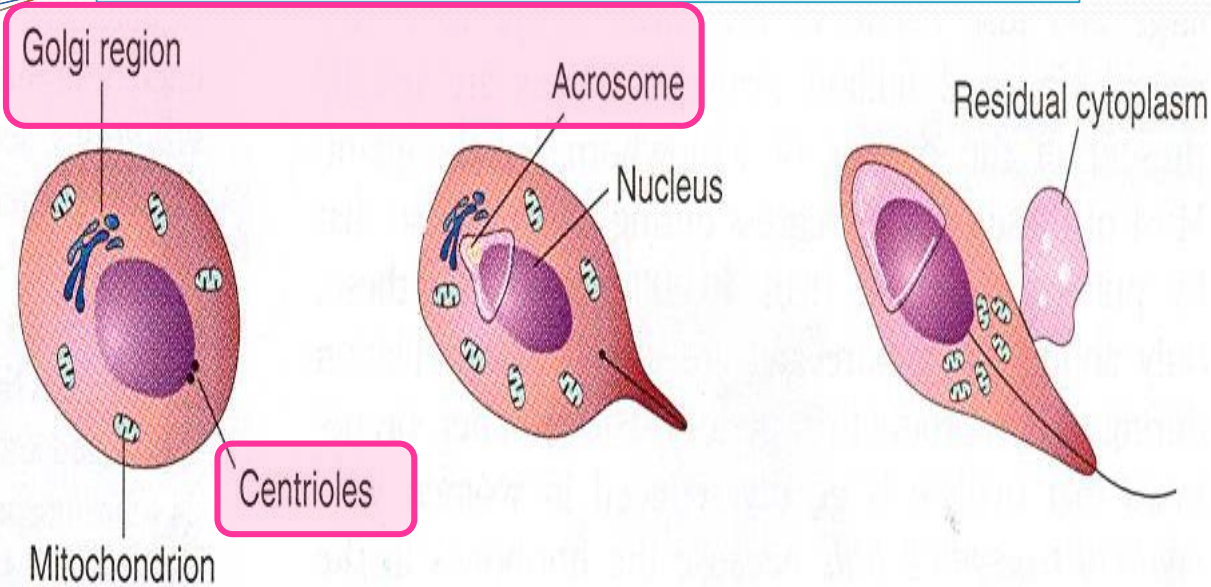
- **AIM:**
- Formation of sperms with haploid number of chromosomes.
- **SITE:**
- **Seminiferous tubules** of the testis.
- **TIME:**
- From puberty till old age.
- **DURATION:**
- **About two months**
- **N.B. Sperms are stored and become functionally mature in the Epididymis.**

SPERMATOGENESIS

- Each **daughter Spermatogonia** grows to give **primary spermatocyte (46)**.
- **Primary spermatocyte** undergoes **meiotic** division to give **2 secondary spermatocyte (22+ x) or (22+y)**.
- **Secondary spermatocytes** undergo **2nd meiotic division** to form **4 haploid spermatids** (half size).
- **Spermatids** are transformed into **4 mature sperms** by a process called **spermiogenesis**.



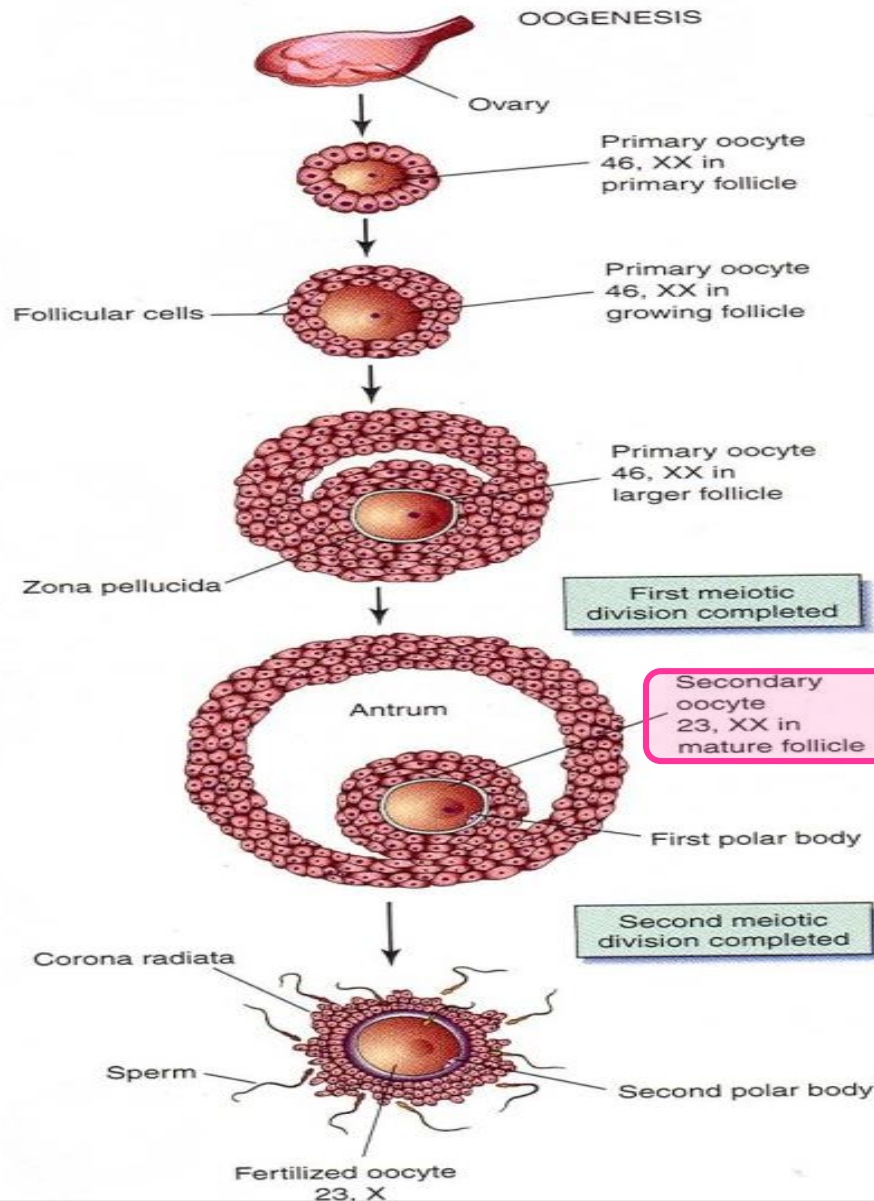
SPERMIOGENESIS



- It is **change in shape** (**metamorphosis**) **through which Spermatids are transformed into mature Sperms**:

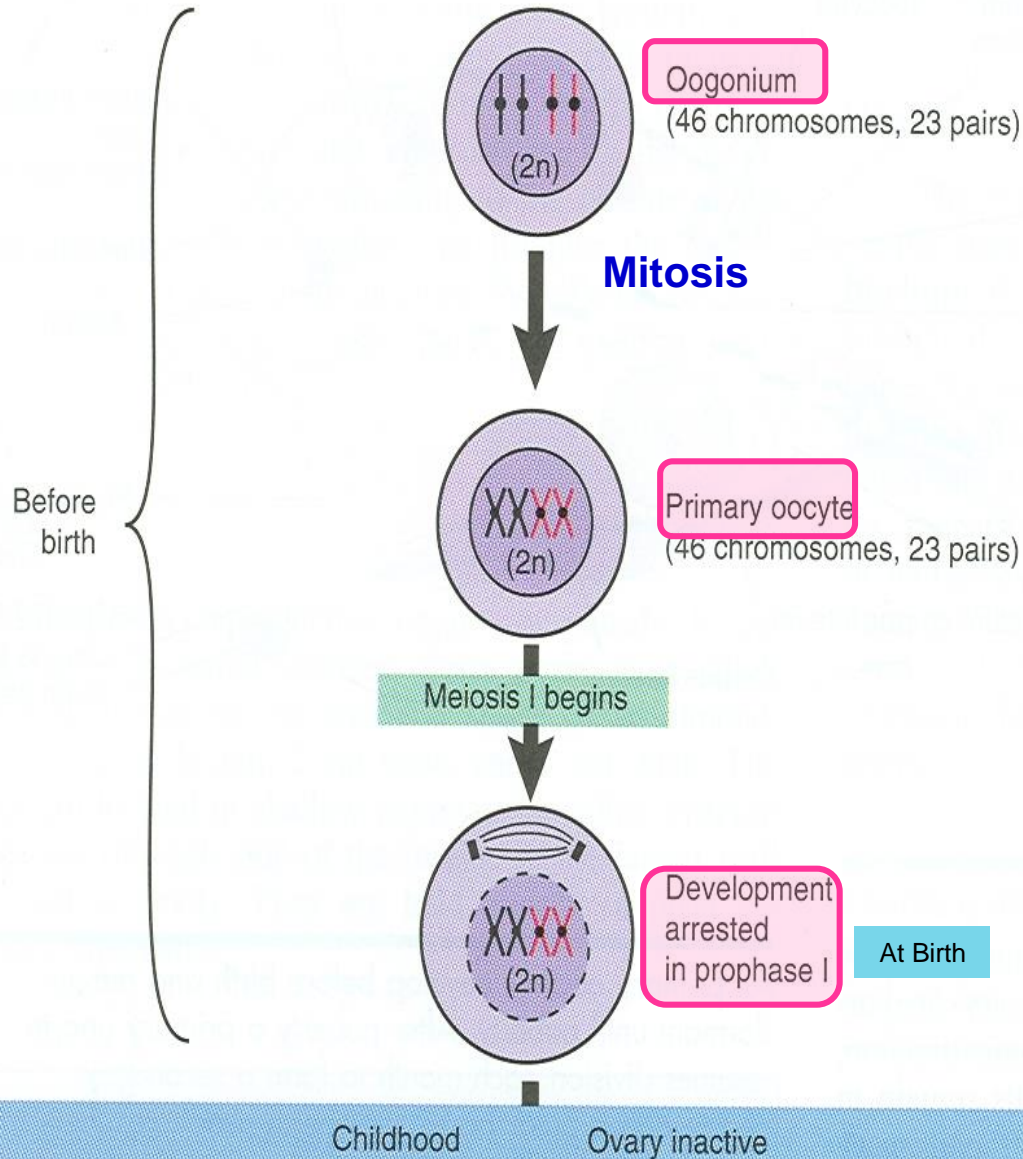
1. **Nucleus** is condensed and forms most of the **head**.
2. **Golgi apparatus** forms the **Acrosome**.
3. **Mitochondria** forms a **spiral sheath**.
4. **Centriole** elongates to form the **axial filament**.

OÖGENESIS



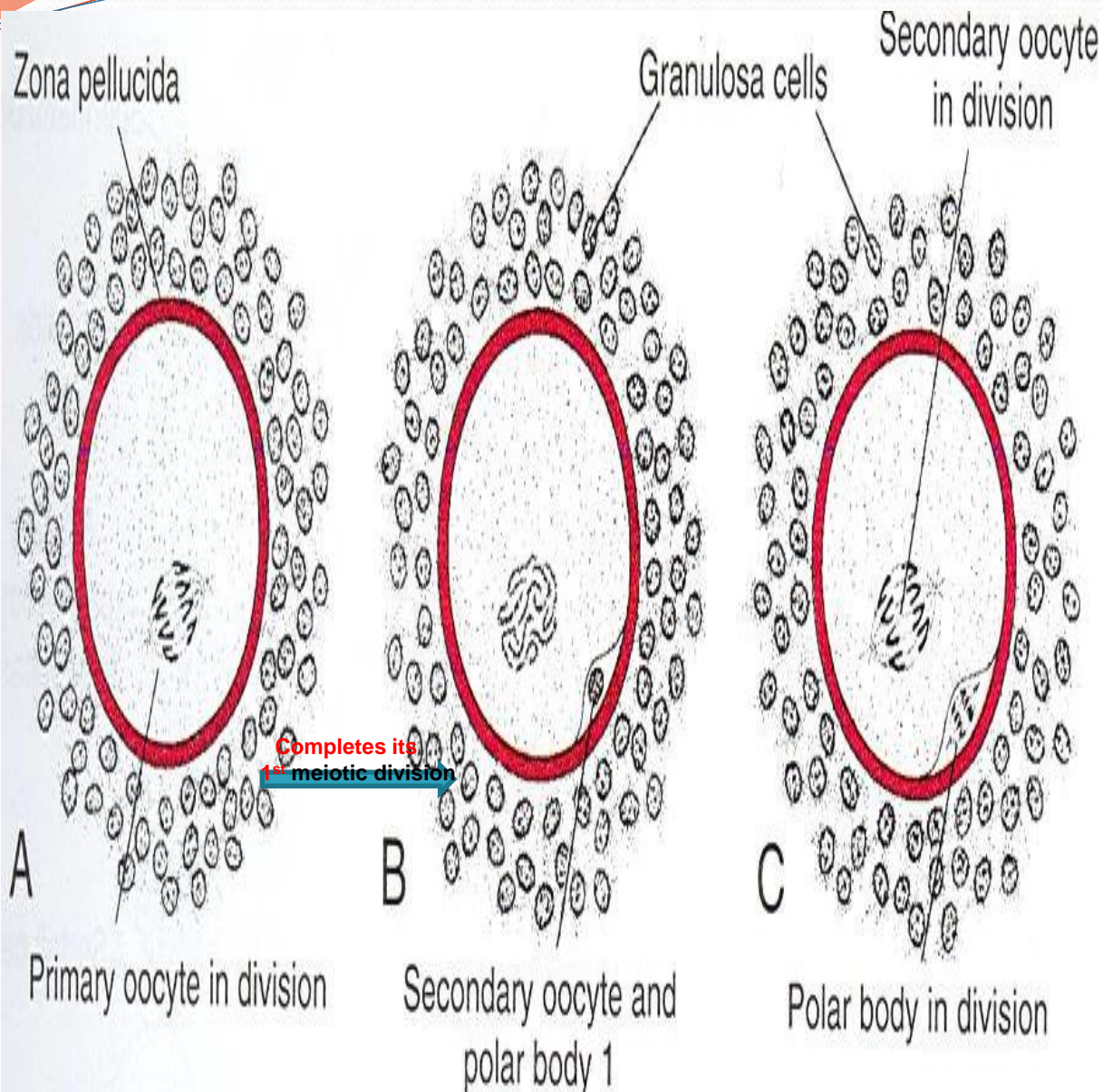
- **AIM:**
- Formation of secondary oocytes with haploid number of chromosomes.
- **SITE:**
- Cortex of the **ovary**
- **TIME:**
- Starts during fetal life becomes **completed** after puberty & **continues** until menopause.
- It occurs *monthly* Except during *pregnancy*.

O O G E N E S I S



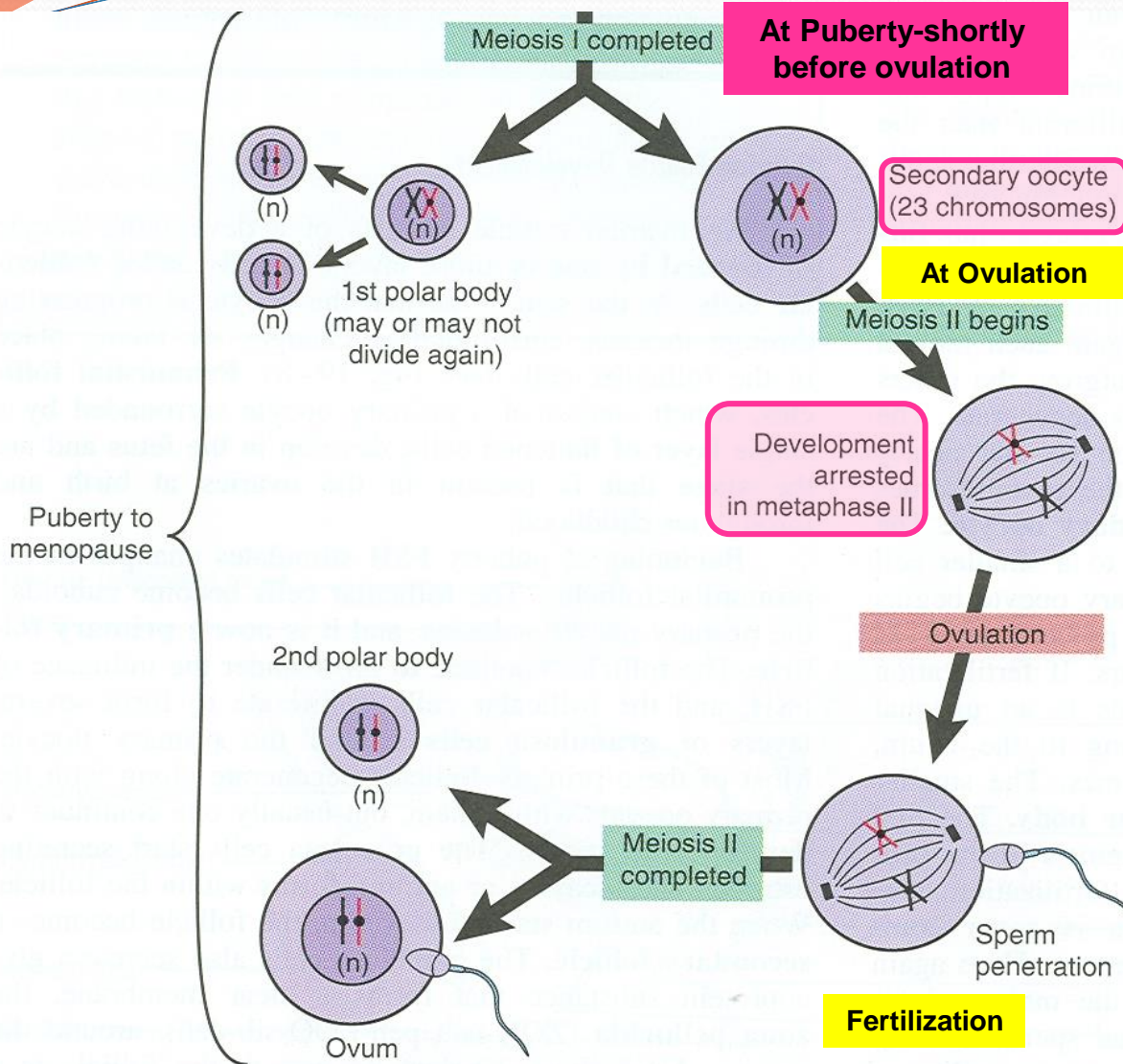
- **Before Birth:**
(During fetal life),
primitive ova (**Oogonia**).
proliferate by mitotic
division and enlarge to
form **Primary Oocytes**
(46)
- **Before birth & At Birth :**
all primary oocytes
remain arrested in
prophase I of the
1st meiotic division.
- And do **not finish** their
first meiotic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

O O G E N E S I S



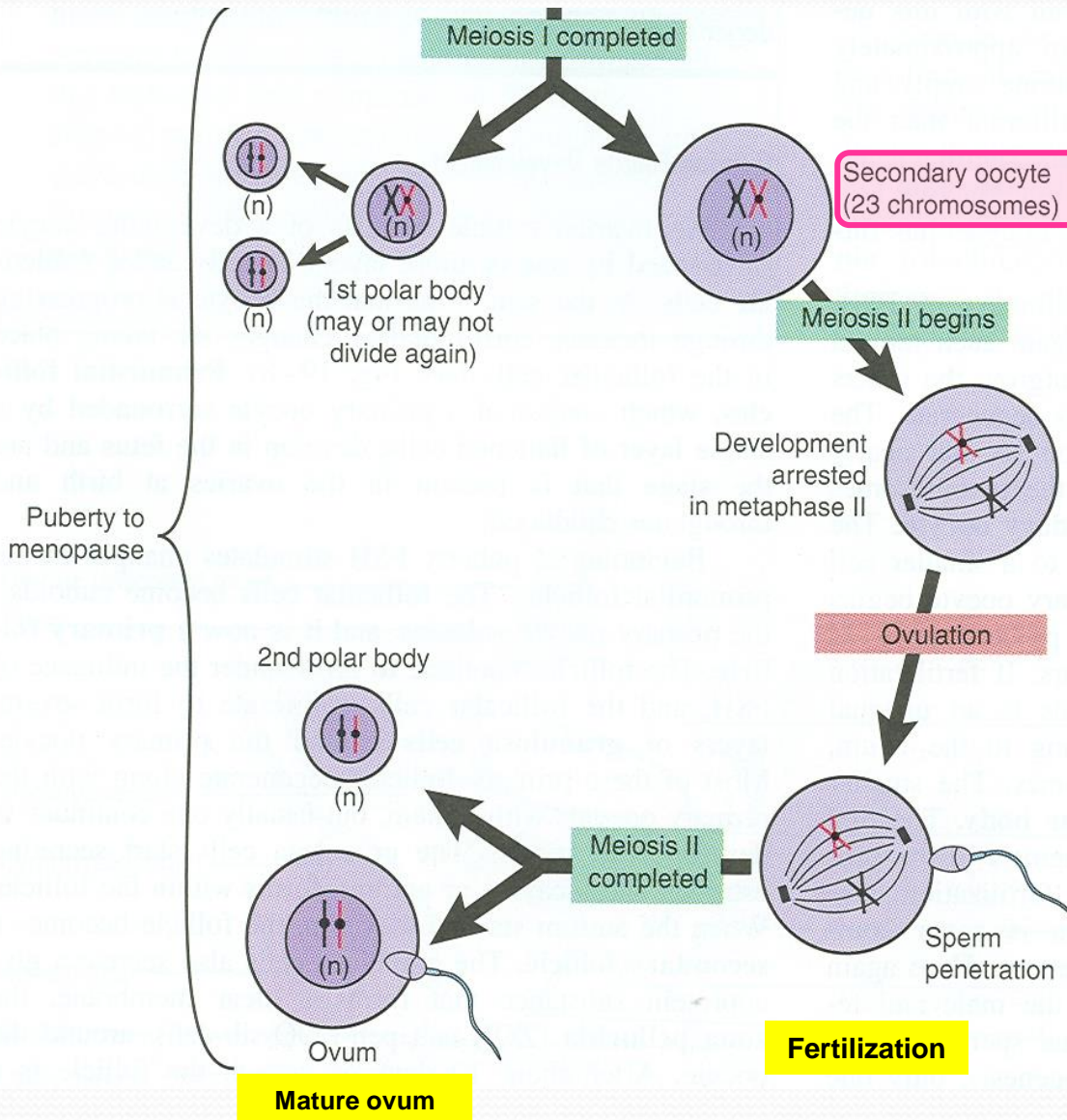
- At Puberty
- Shortly before ovulation;
Primary Oocyte completes its first meiotic division to give **Secondary oocyte (2n)** & **First Polar Body**.
- The Secondary Oocyte receives almost all the cytoplasm.
- The First Polar Body receives very little.
- It is small nonfunctional cell that soon degenerates.

OOGENESIS



- **At ovulation** : **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**
- The rest is in the **2nd Polar Body** which soon degenerates.

DURING FETAL LIFE

Proliferation:

each oogonium divides by mitosis into 2 daughter oogonia (with **diploid** number of chromosomes: (44 + XX))

Growth:

oogonium enlarges to form primary oocyte (with **diploid** number).

Primary oocytes begin 1st meiotic division which stops at prophase

AFTER PUBERTY DURING EACH OVARIAN CYCLE

1st meiotic division is completed: (shortly before ovulation):

a reduction division by which a primary oocyte divides into one secondary oocyte (**haploid** number of chromosomes: (22 + X) & 1st polar body (degenerates))

2nd meiotic division begins: begins at ovulation, progresses only to metaphase and becomes arrested.

AFTER FERTILIZATION

2nd meiotic division is completed:

2ry oocyte divides into a mature ovum (**haploid** number) & 2nd polar body (degenerates).

N.B.: NO PRIMARY OOCYTES FORM AFTER BIRTH



GOOD LUCK