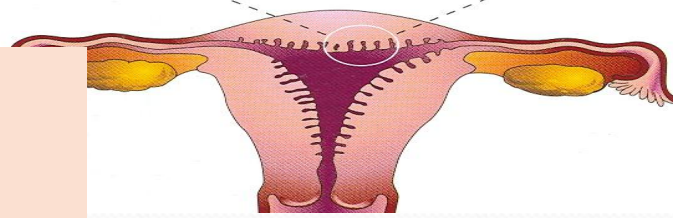
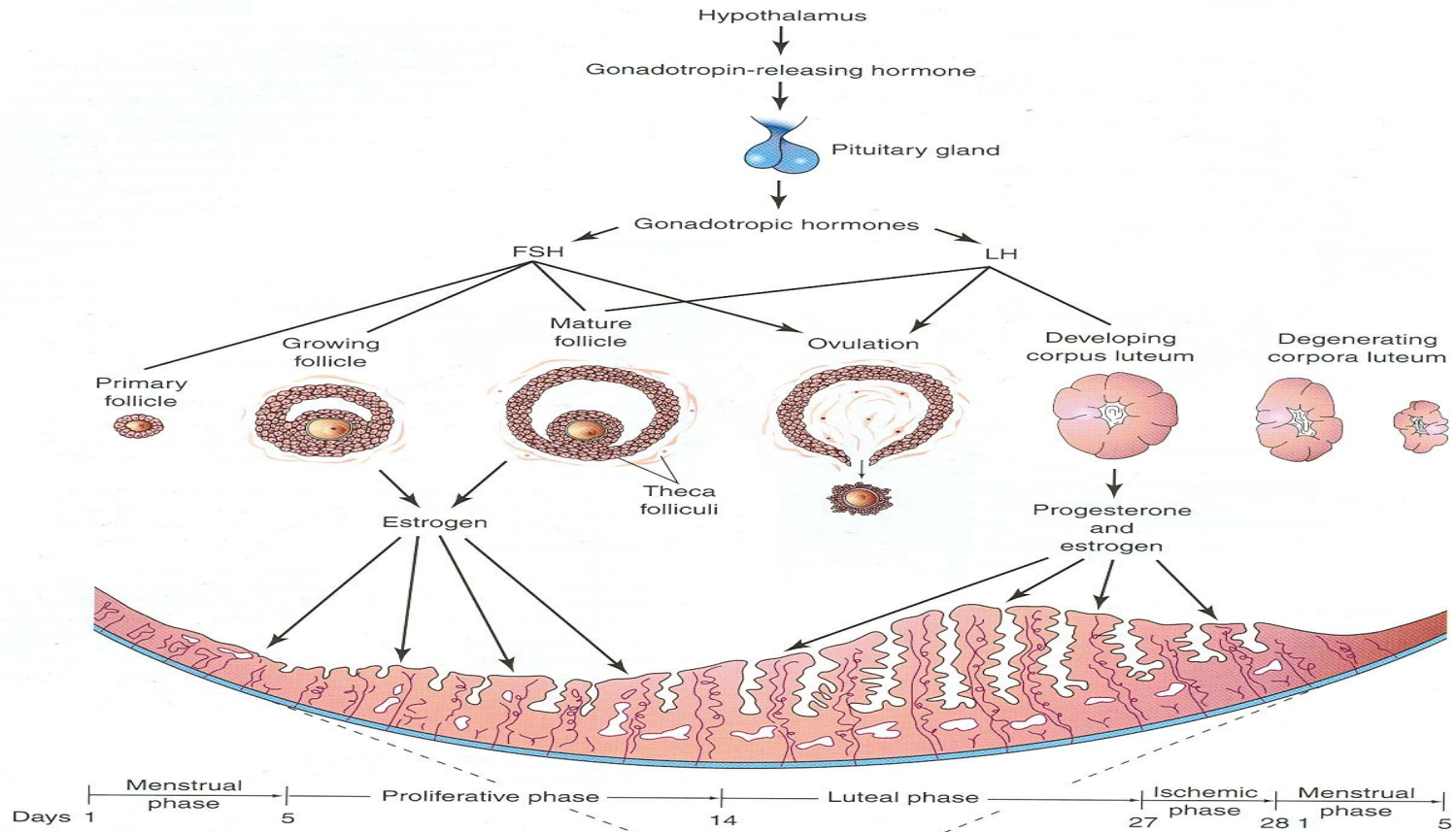


# GAMETOGENESIS & FEMALE CYCLES



By :  
Prof. SaeedAbuelmakarem  
Dr.Sanaa Alshaarawy

# OBJECTIVES

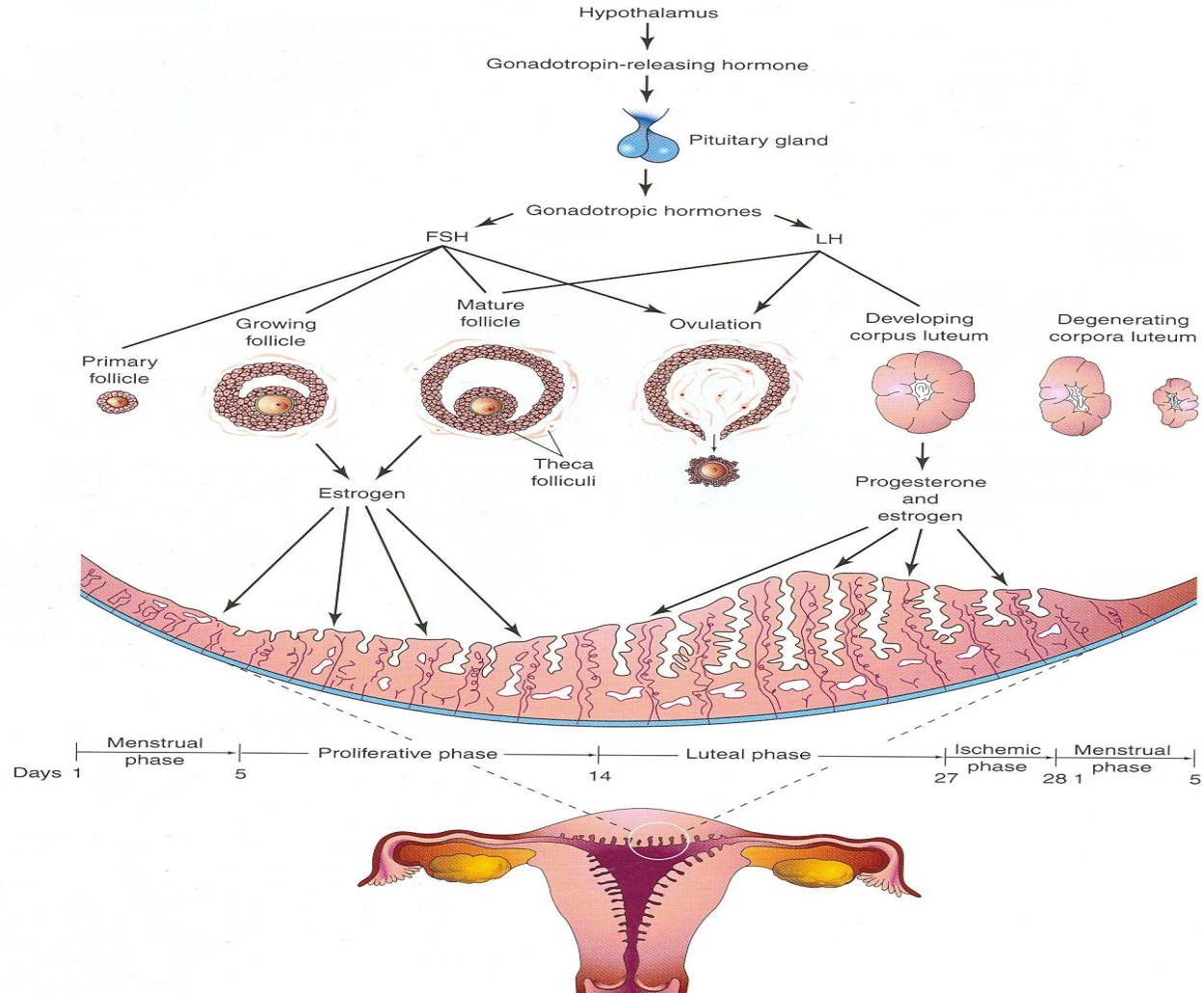
- *By the end of the lecture, you should be able to:*
- Describe the female cycles (**Ovarian & Uterine**).
- Define **gametogenesis**.
- Differentiate the types of **gametogenesis**.
- Describe the process of **spermatogenesis**.
- Describe the process of **oogenesis**.

# Female Reproductive Cycles

## OVARIAN AND UTERINE CYCLES

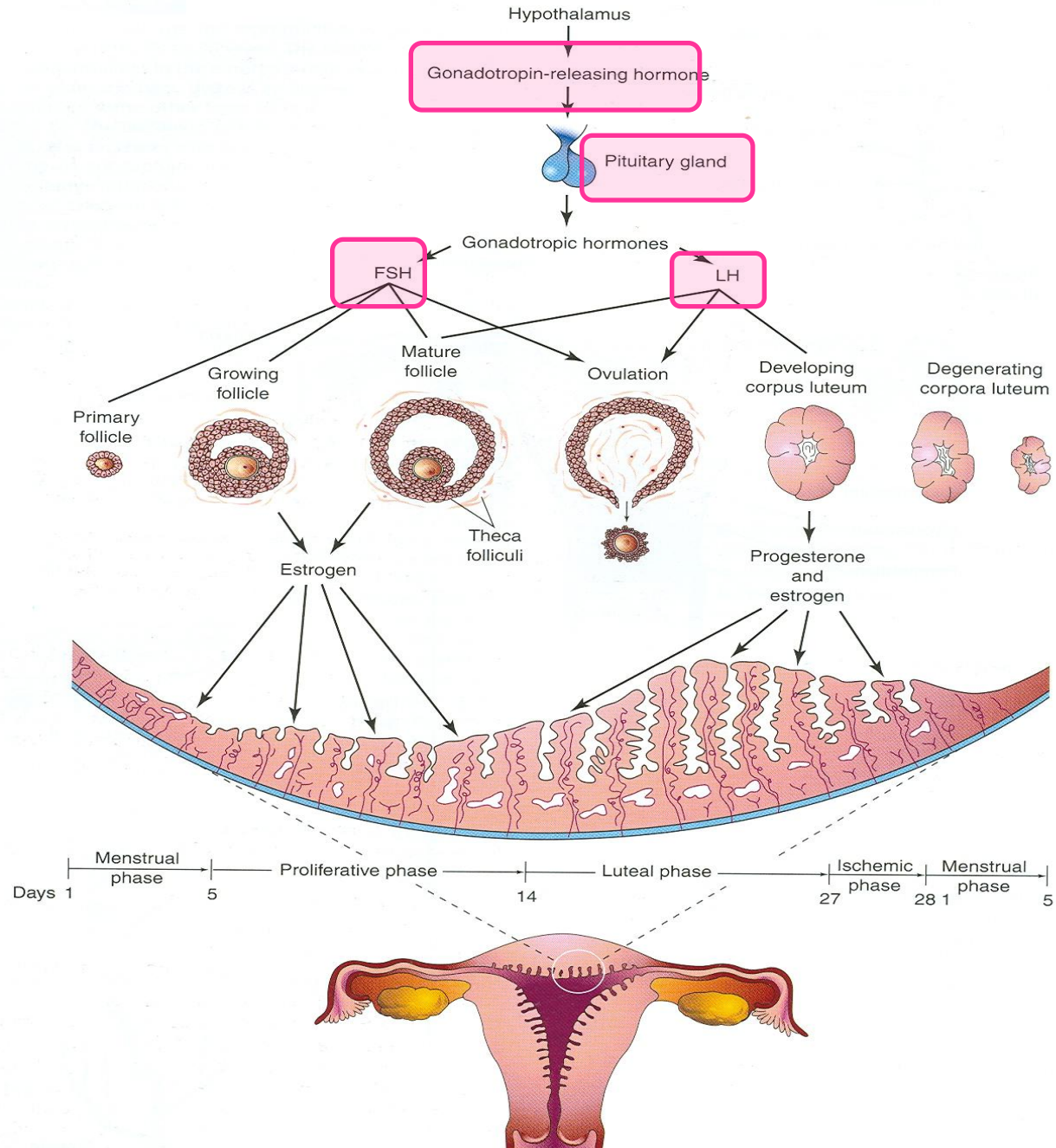
- **Start** at puberty.
- Normally continues until the **menopause**.
- Reproductive cycles depend upon activities & coordination of:

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

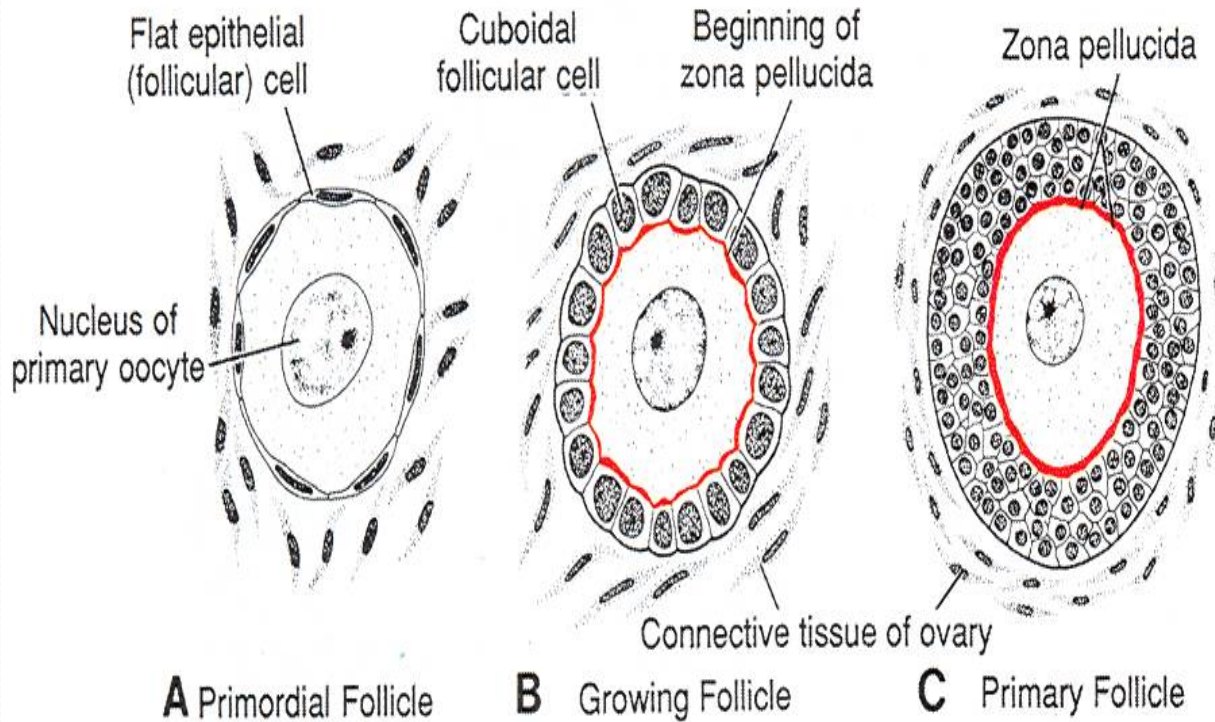


# GnRH

- **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



## FSH

**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 follicle.

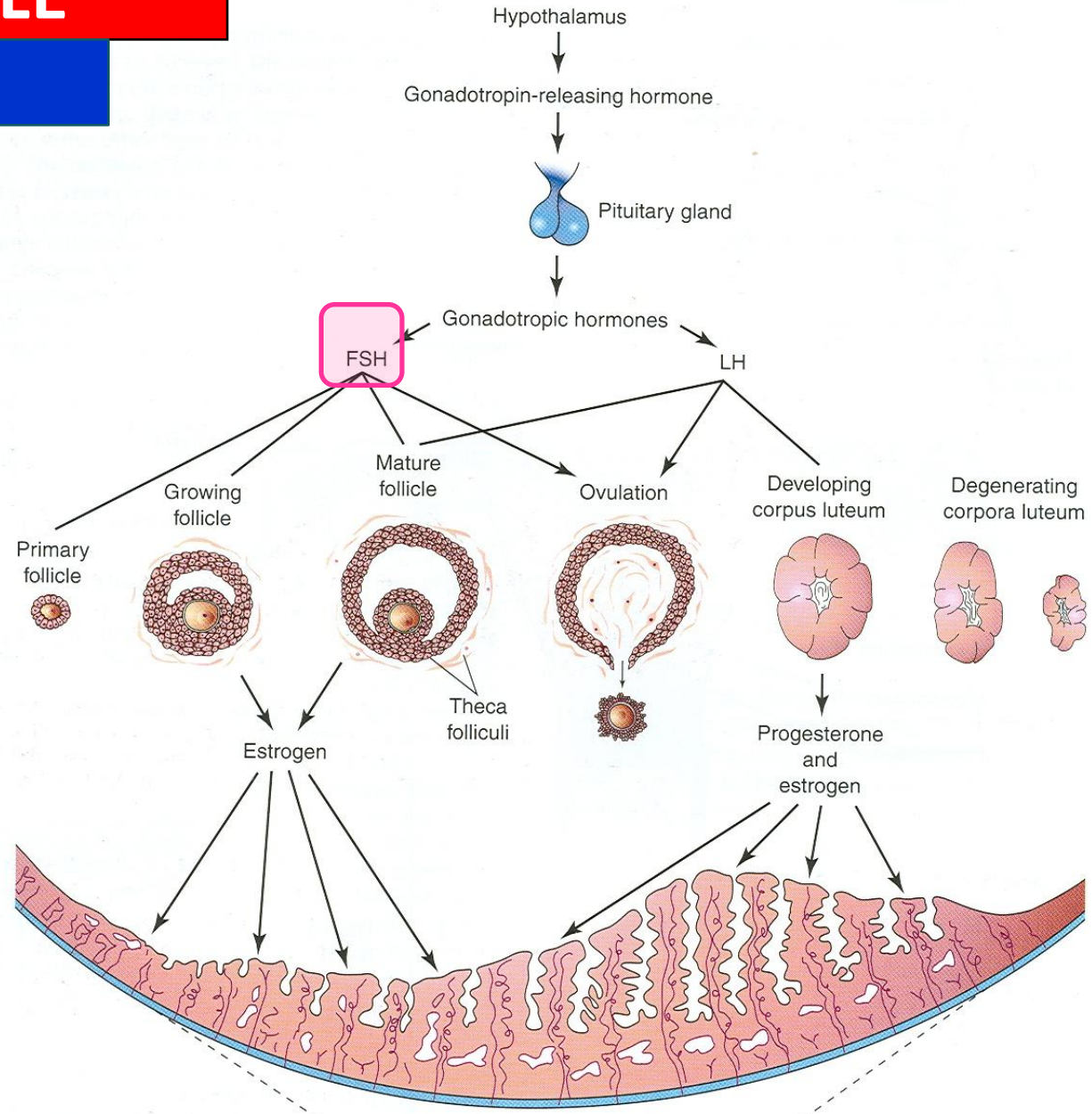
- The **ovarian cycle** is under the control of the **Pituitary Gland**.
- **It is divided into 3 phases: (FOL)**
- **1- Follicular, (FSH)**
- **2- Ovulatory, (LH).**
- **3- Luteal. (LH).**
- The ovarian cortex contains **hundreds of thousands of primordial follicles** (400,000 to 500,000).
- **Each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

# OVARIAN CYCLE

## Follicular Phase

### FSH

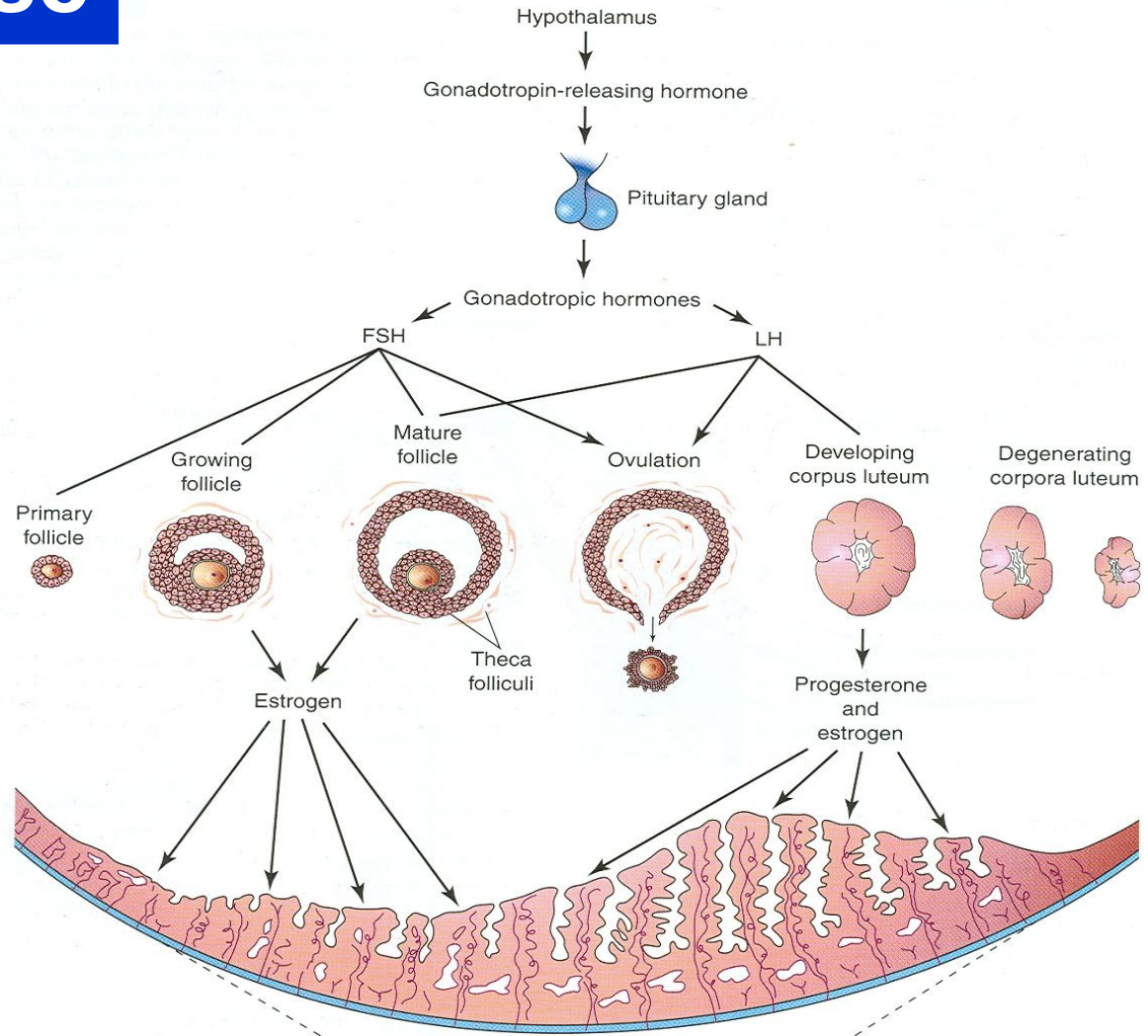
- Follicle-Stimulating Hormone .
- **FUNCTIONS:**
- 1- It stimulates the ovarian primary follicles to develop and become mature.
- 2- Production of Estrogen by the follicular cells.



# Ovulatory Phase

## LH

- The **follicle** becomes enlarged until it gets **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**.
- **LH** causes **ovulation** (rupture of the mature follicle).



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

# Ovulatory Phase

## LH

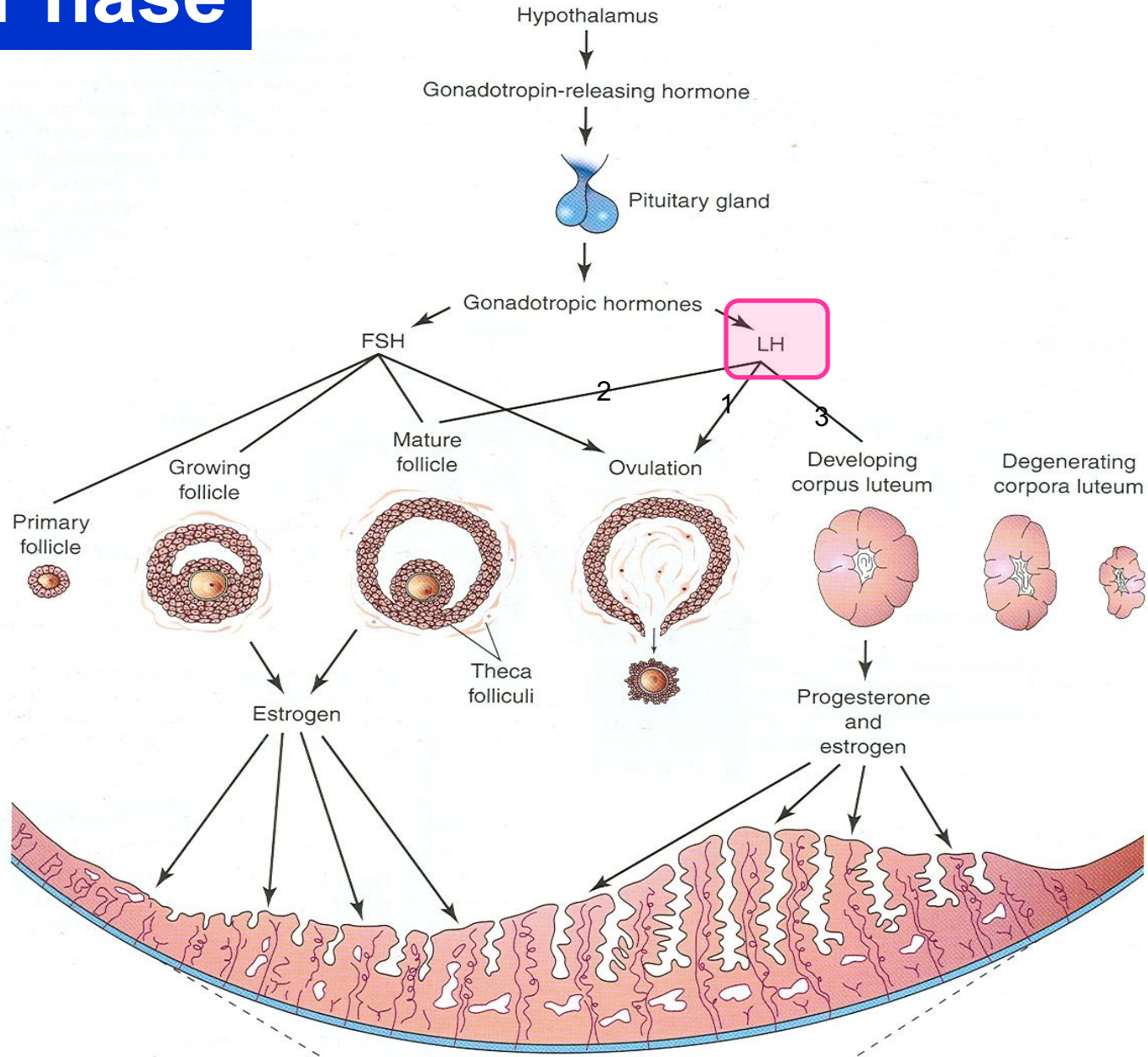
**Luteinizing Hormone.**

### 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**.

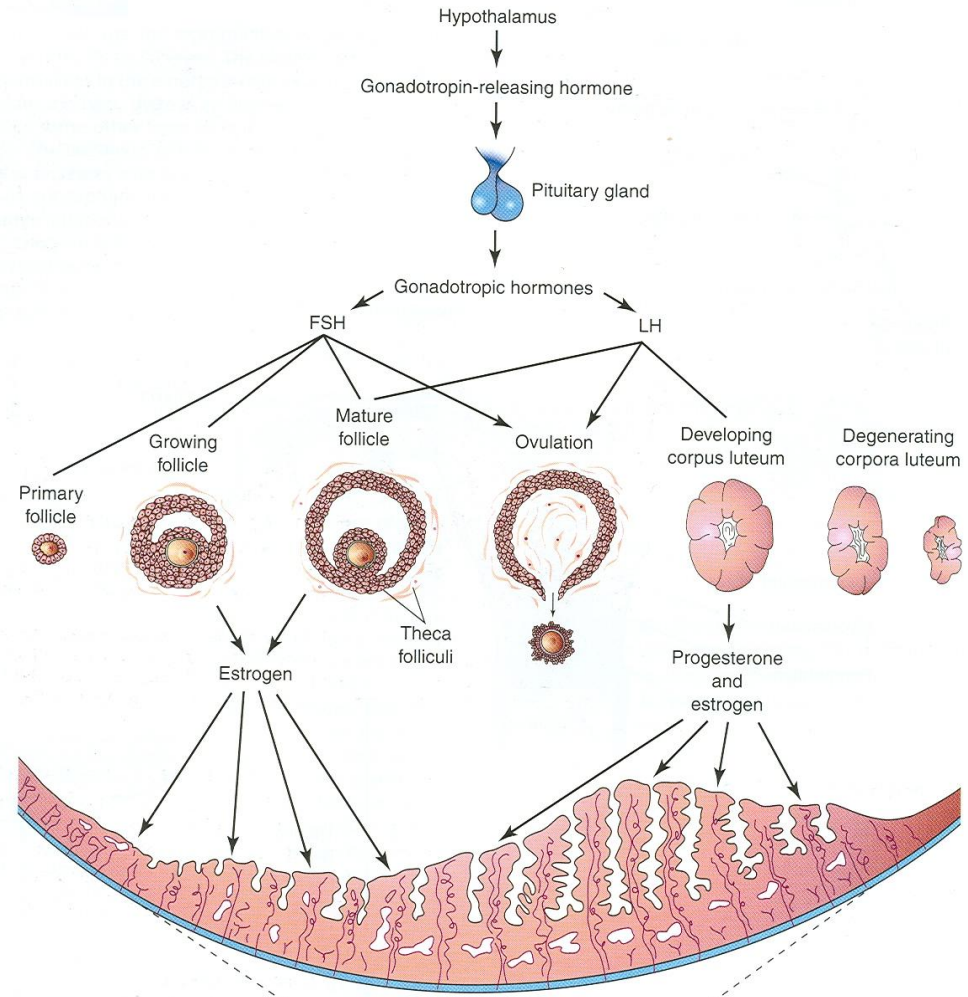
- It secretes **Progesterone** and **small amount** of **Estrogen**.

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

- If the **oocyte** is **fertilized** the **Corpus Luteum** enlarges and **remains** till the **4<sup>th</sup> month** of pregnancy.

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

# Corpus Luteum



- Cyclic changes in the endometrium of the uterus caused by estrogen & progesterone.

- Average menstrual cycle is 28 days.

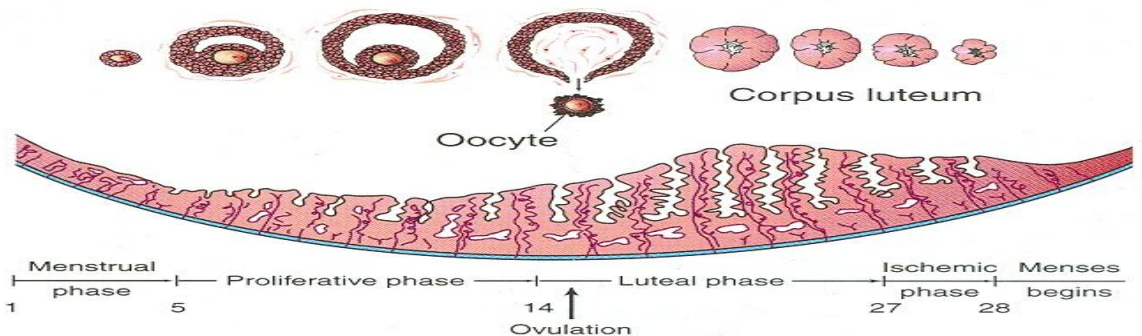
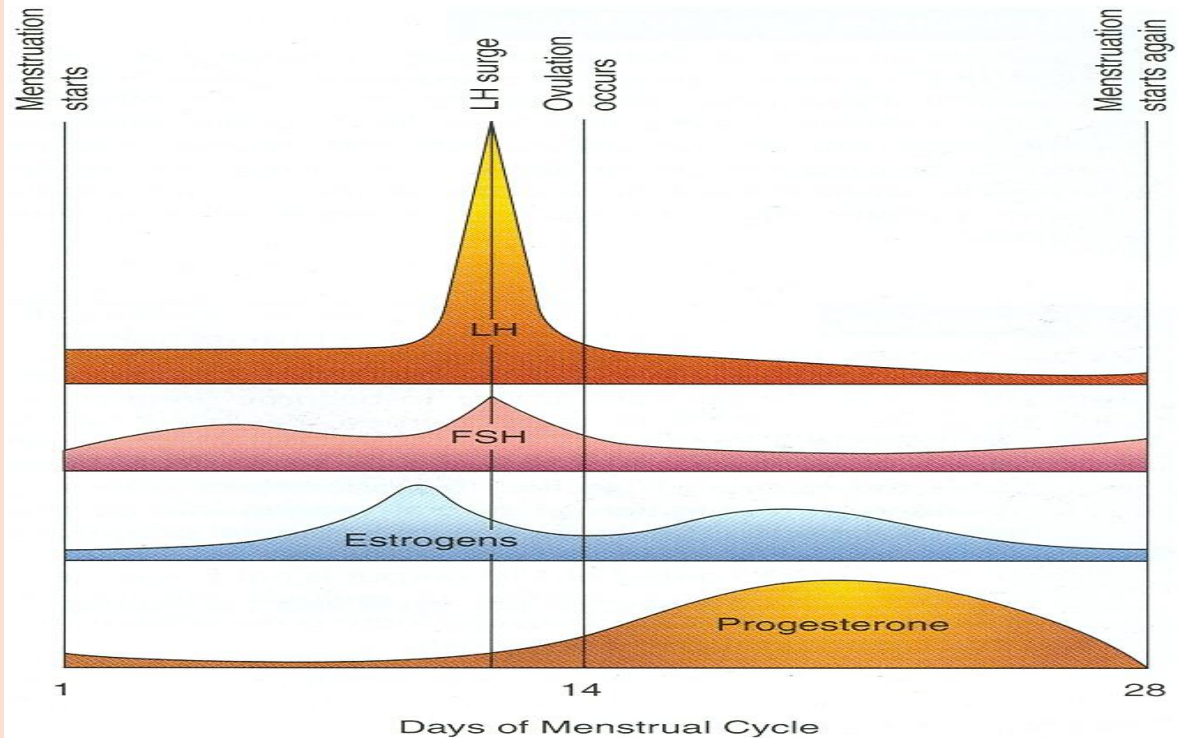
- Day **One** is the day when **menstrual blood** flow begins.

- It varies by several days in normal women.

- Ranges between 23 and 35 days in 90% of women.

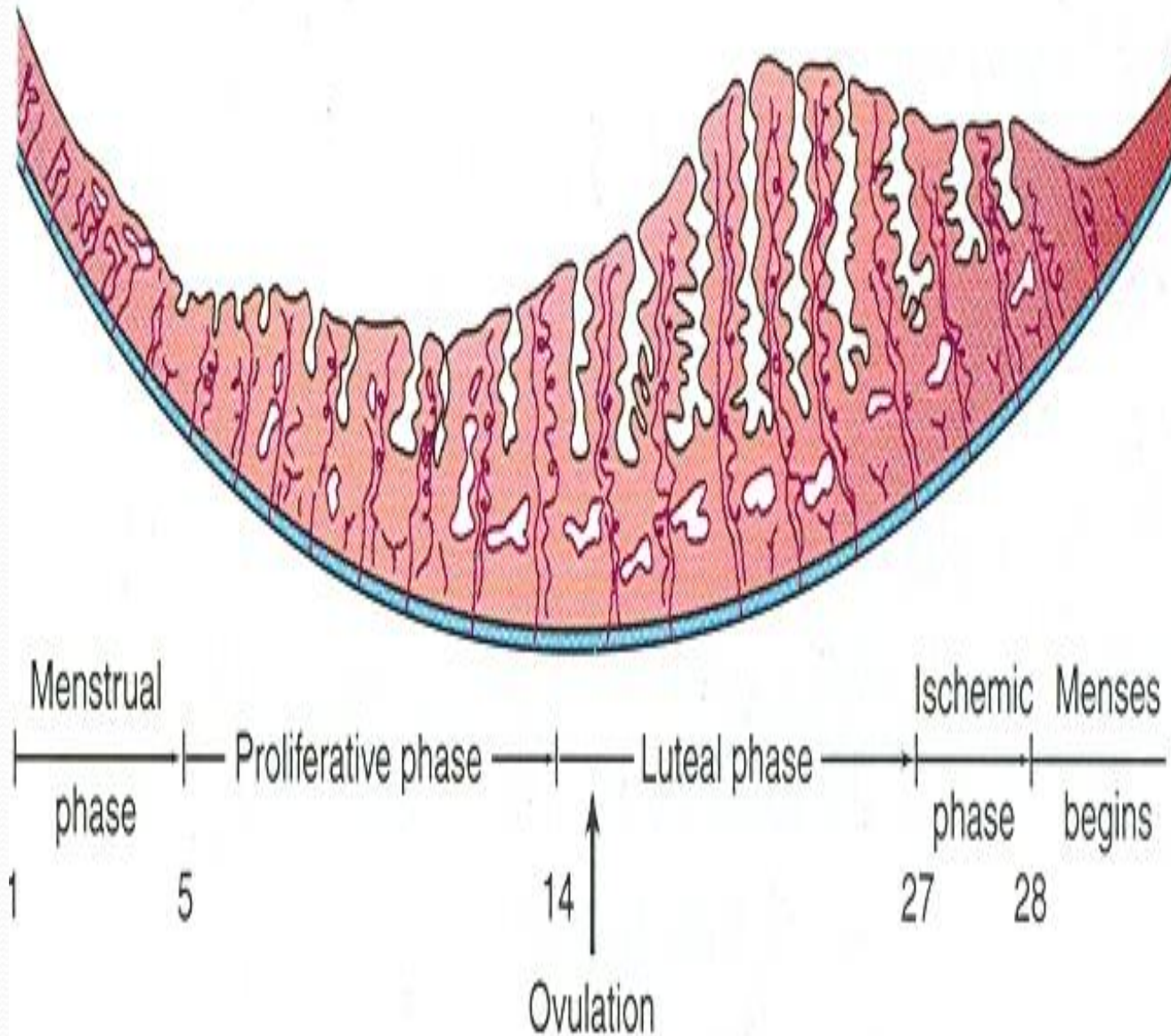
- It sometimes varies in the same woman.

# Uterine or Menstrual Cycle



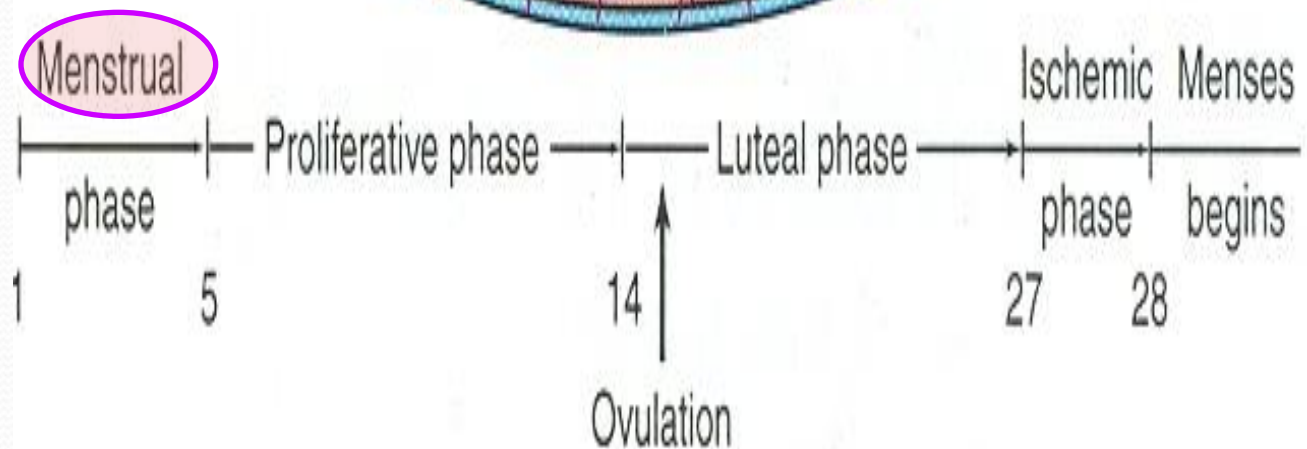
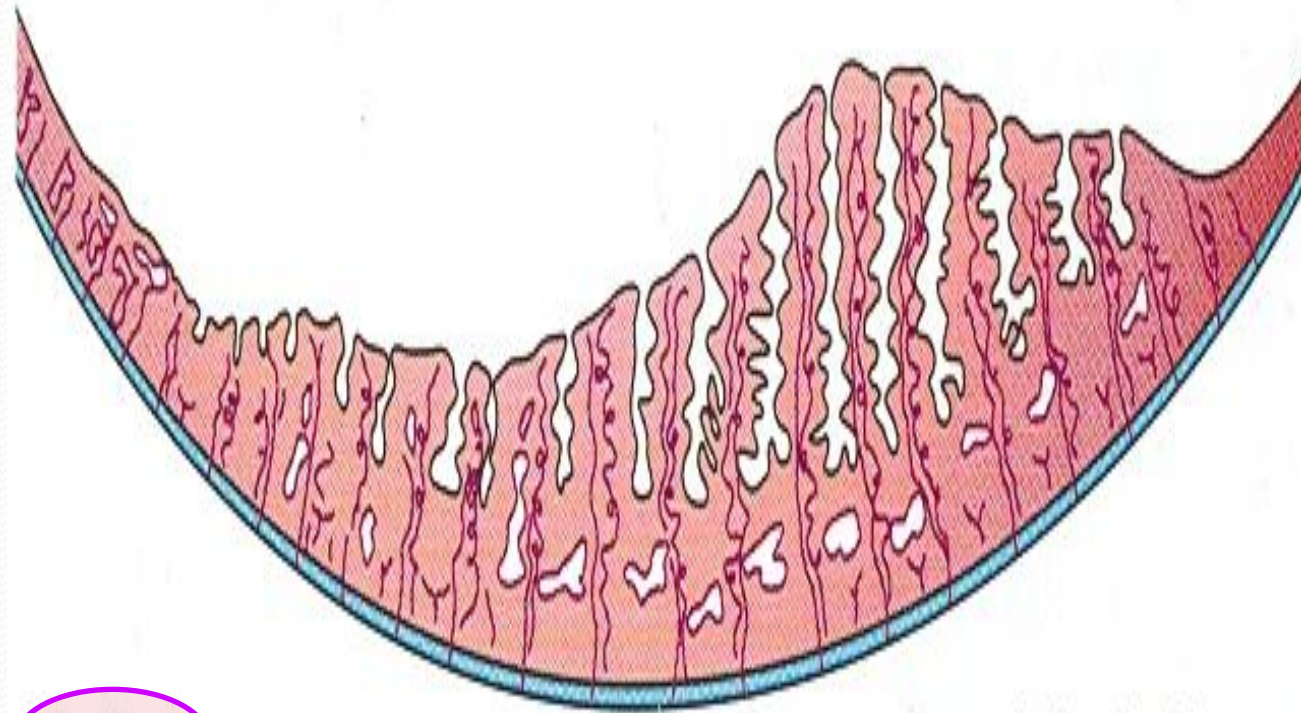
# Phases of Menstrual Cycle

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



# Menstrual Phase

- Starts with 1<sup>st</sup> day of menstrual cycle.
- Lasts for 4-5 days.
- **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.**



- Is a phase of repair and proliferation.

- Lasts for 9 days.

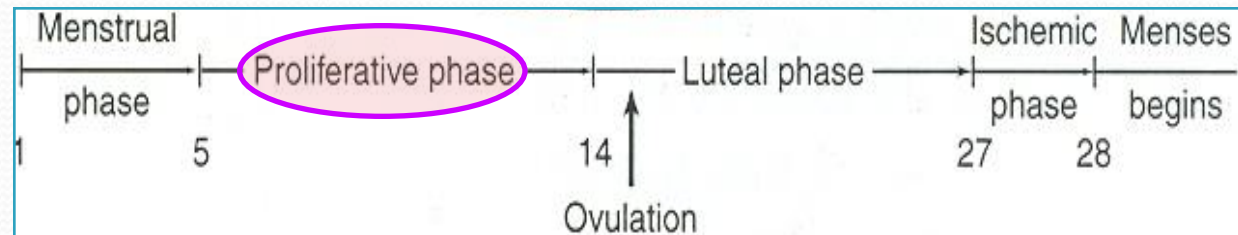
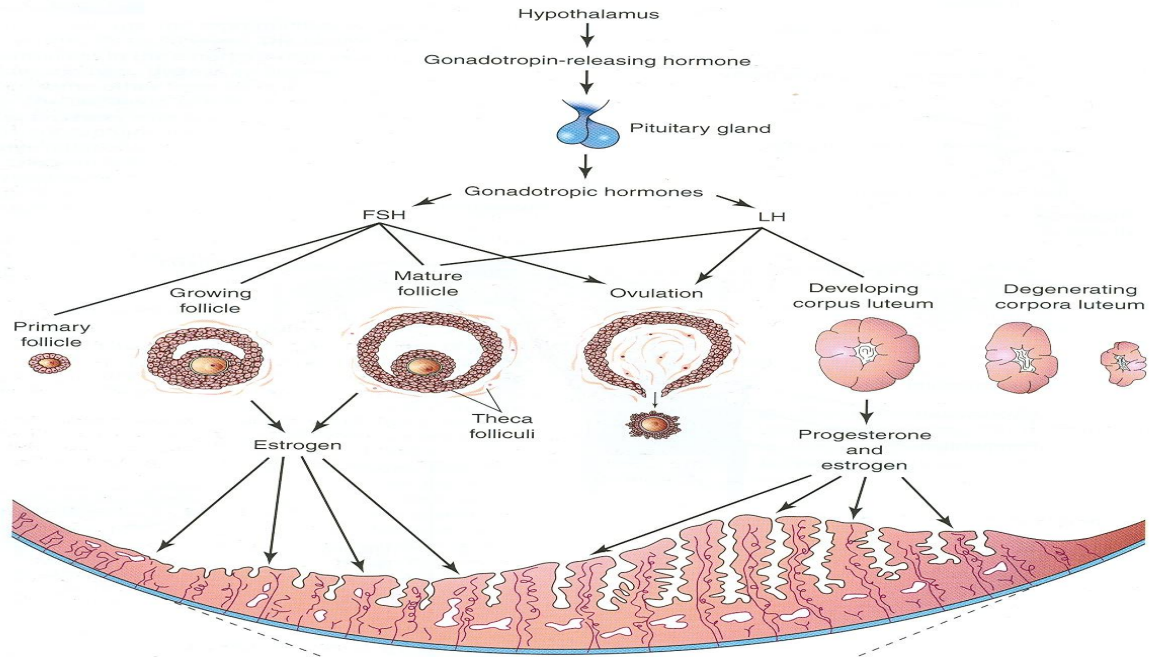
- Coincides with growth of ovarian follicle (Follicular Phase).

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

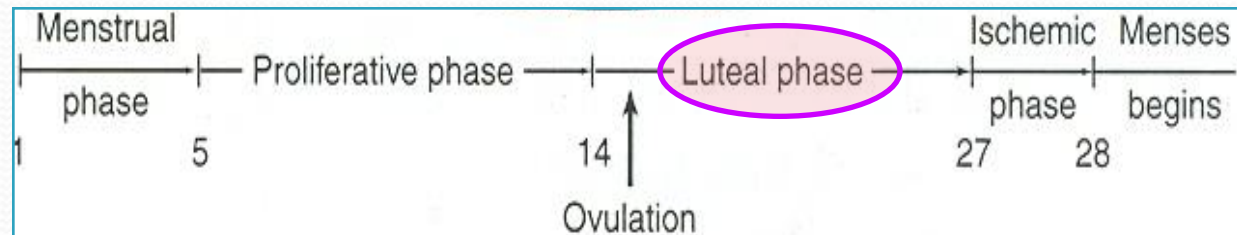
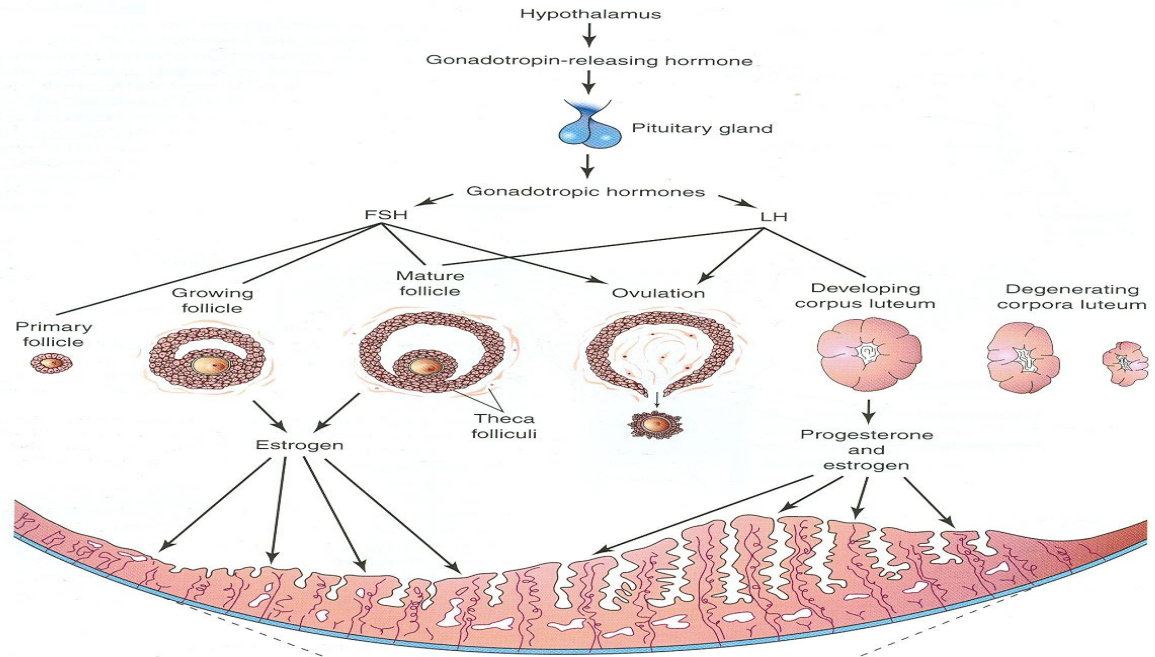
- Thickness of the endometrium is increased into 2-3 folds.

- 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.

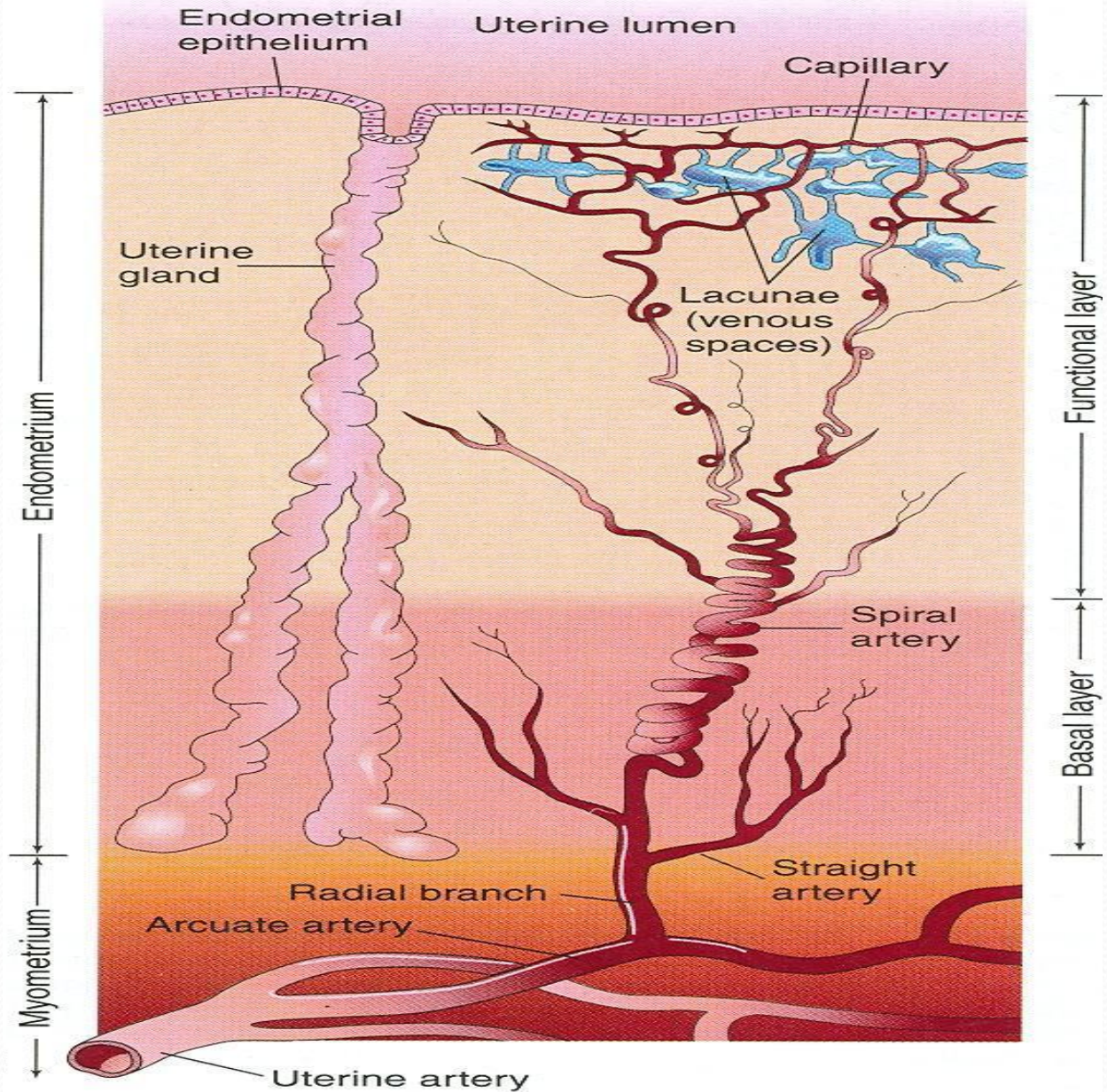
- **Coincides with** the **formation, growth and functioning of the Corpus Luteum**.

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

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

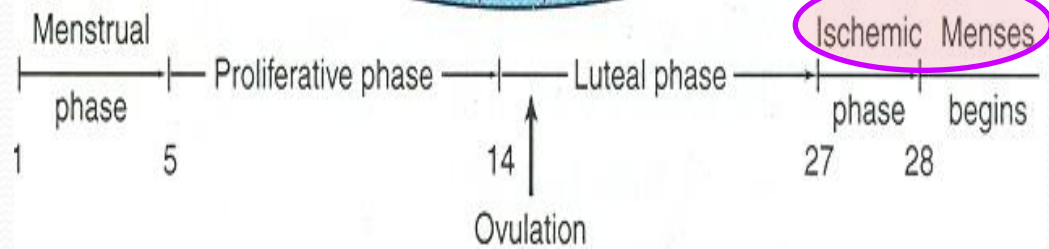
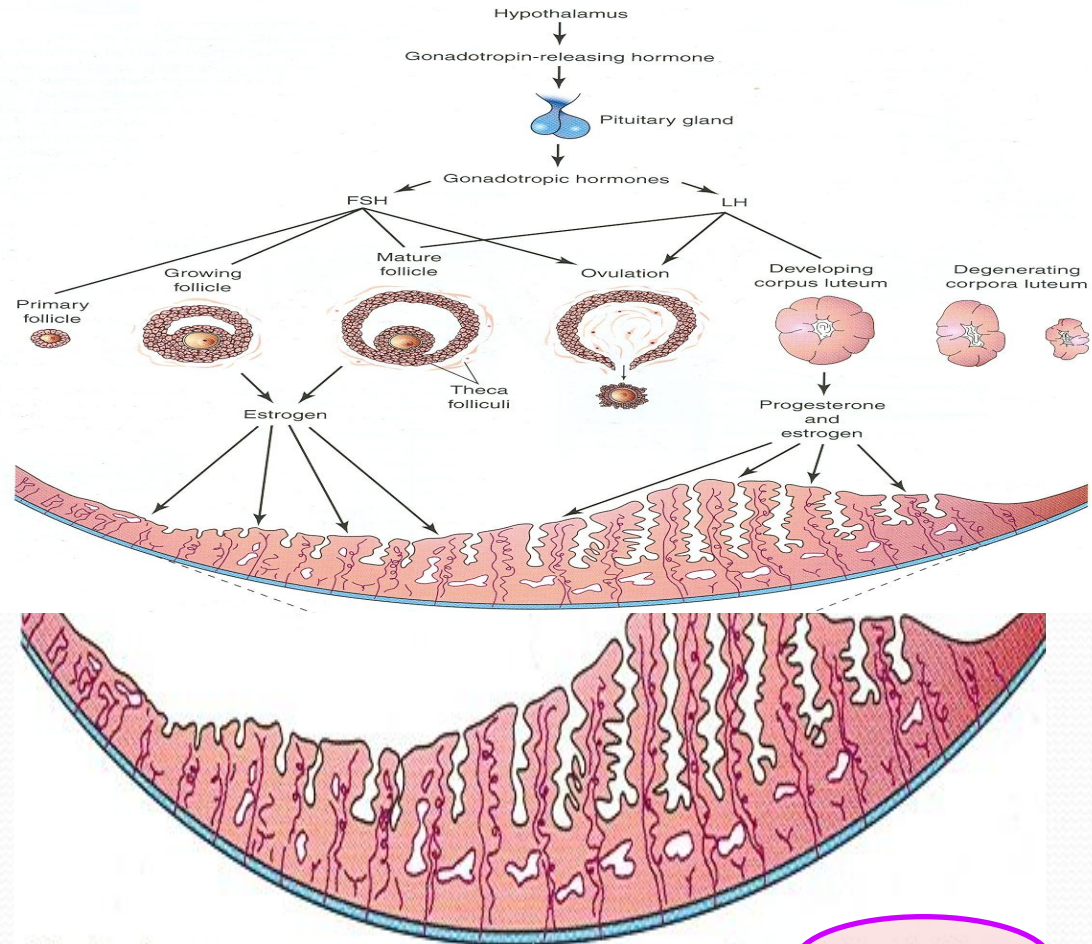
# Luteal Phase

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



# Ischemic Phase

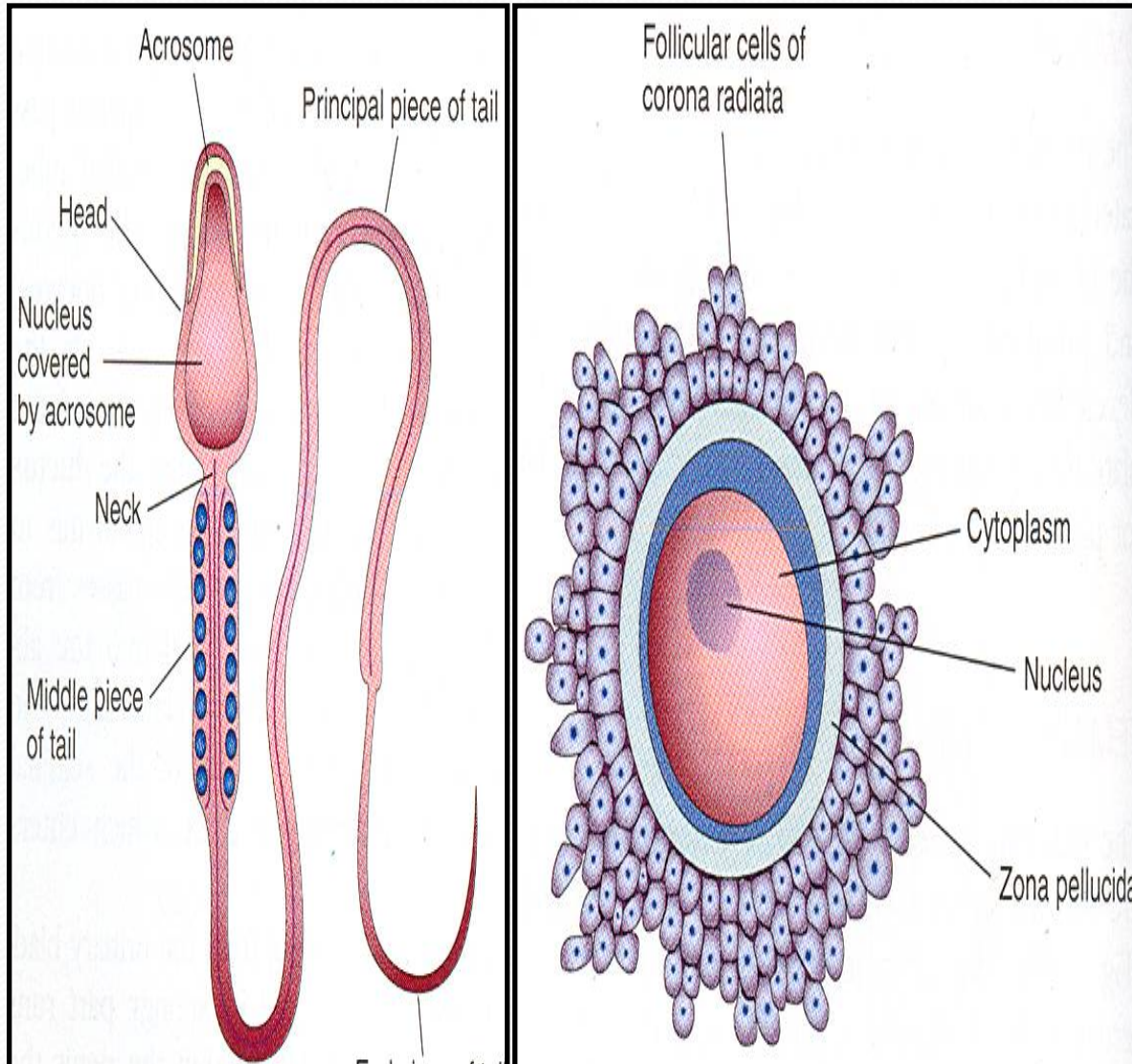
- **Degeneration of corpus luteum** leads to **decrease** the levels of **estrogen & progesterone**.
- **Loss of interstitial fluid.**
- **Marked shrinking of endometrium.**
- **Spiral arteries** become **constricted.**
- **Venous stasis & Ischemic necrosis.**
- **Rupture of damaged vessel wall.**
- **Loss of 20-80 ml of blood**
- **Entire compact layer and most of the spongy layer of endometrium is discarded.**





# **GAMETOGENESIS**

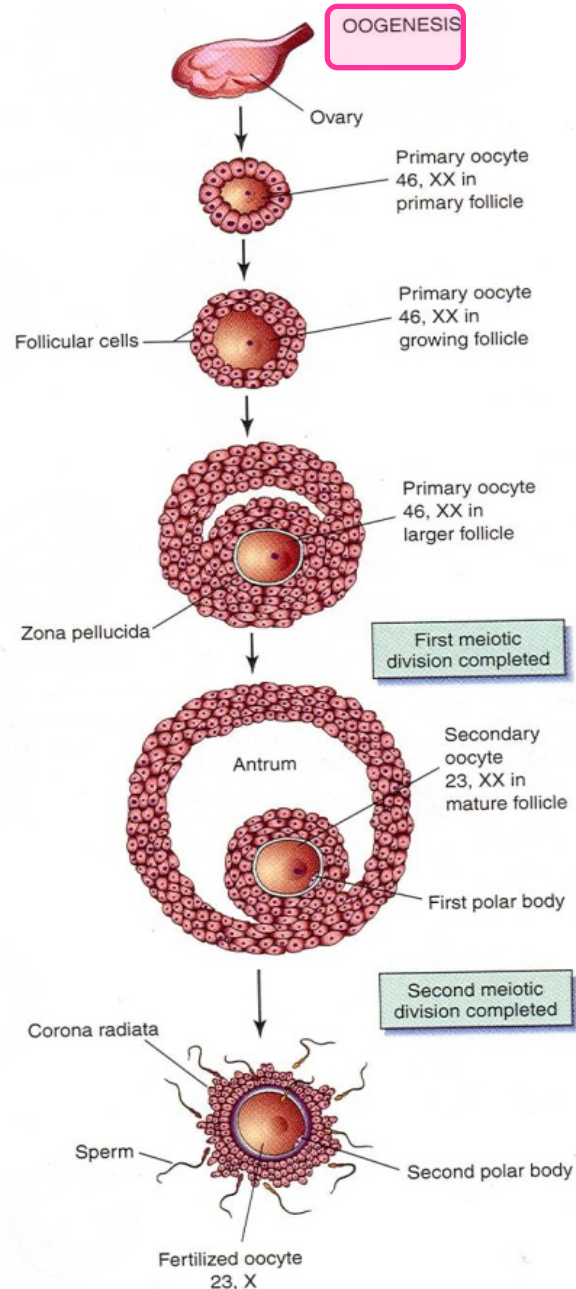
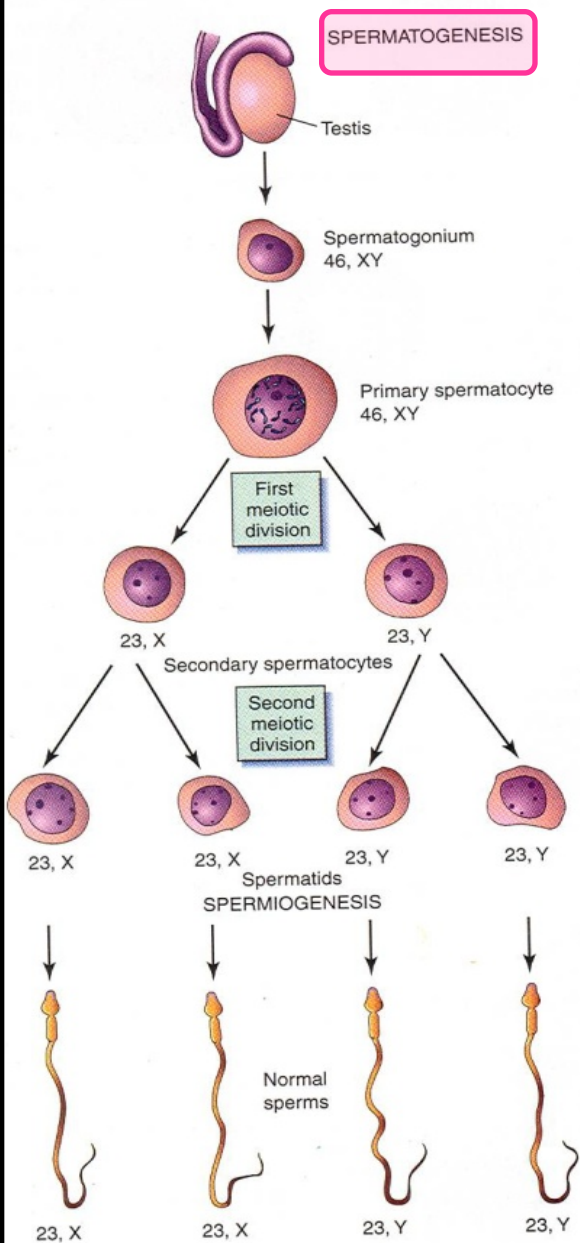
## **(Gamete Formation)**



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**.

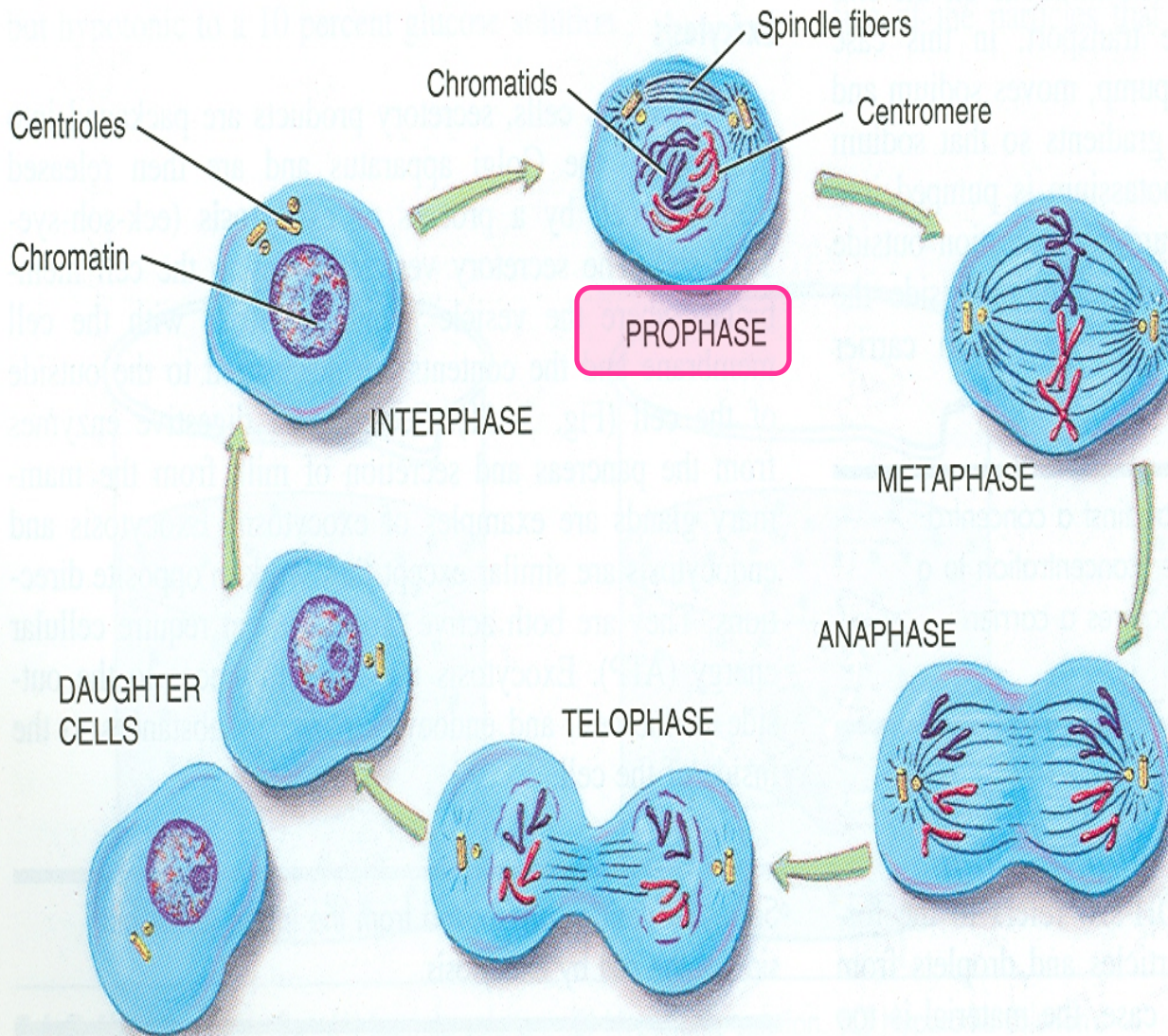
## NORMAL GAMETOGENESIS



# 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).

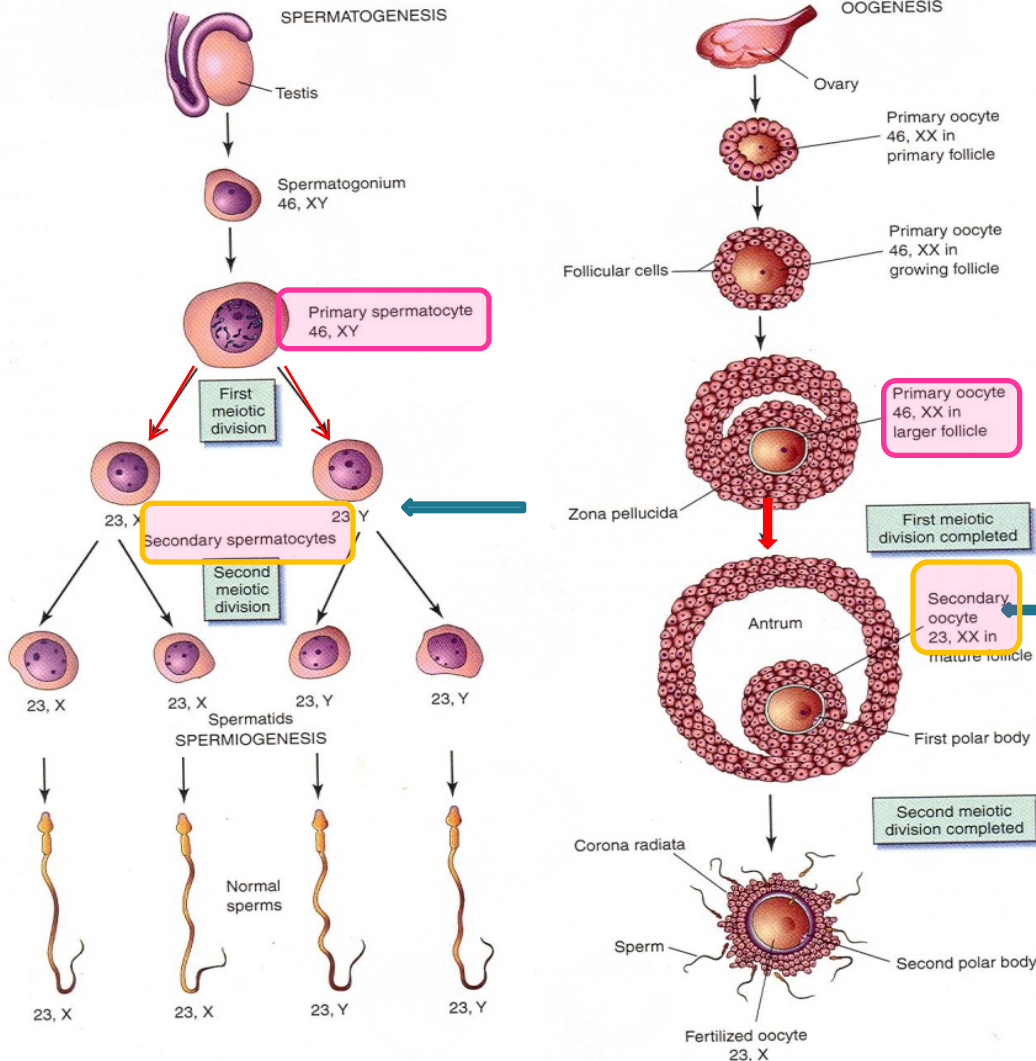
# FIRST MEIOTIC DIVISION



- *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 Chromatids.*

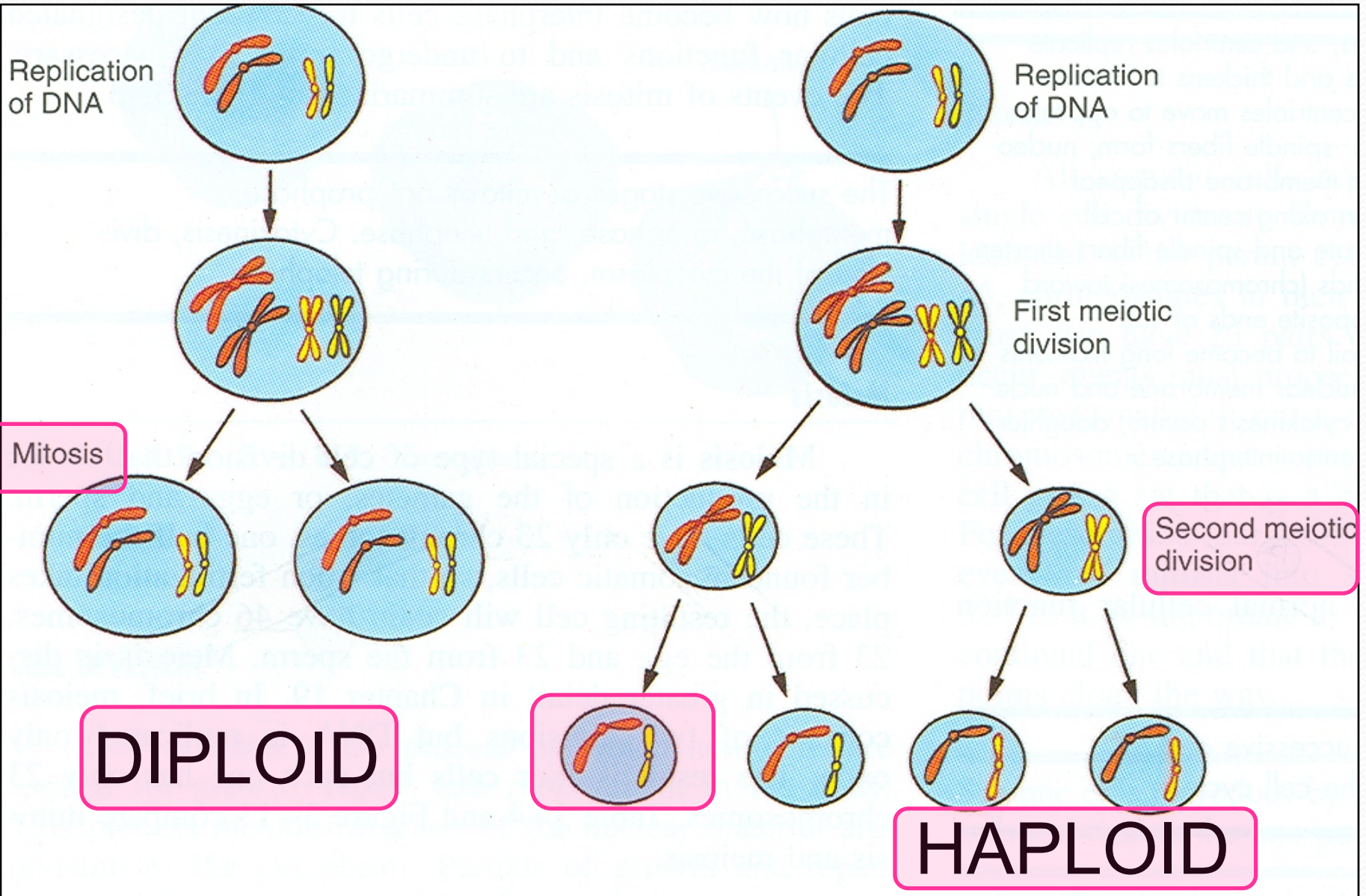
# FIRST MEIOTIC DIVISION

## NORMAL GAMETOGENESIS

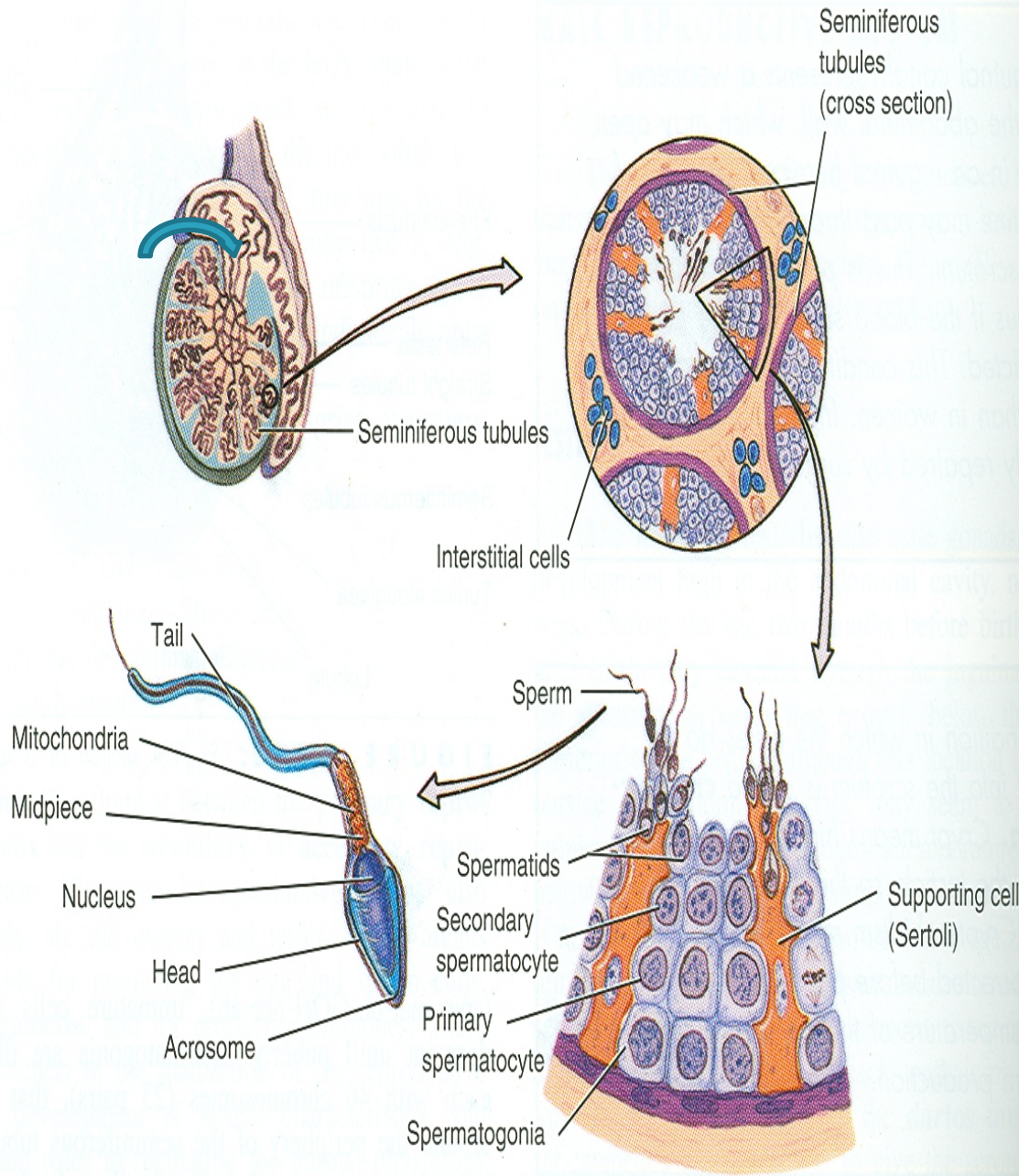


- By the end of the 1<sup>st</sup> meiotic division, each new cell formed (**Secondary Spermatocyte or Secondary Oocyte**) has haploid (half) number of chromosome.
- It is half number of chromosomes of the **Primary Spermatocyte or primary Oocyte**.

# WHAT IS THE DIFFERENCE BETWEEN MITOSIS & MEIOSIS?



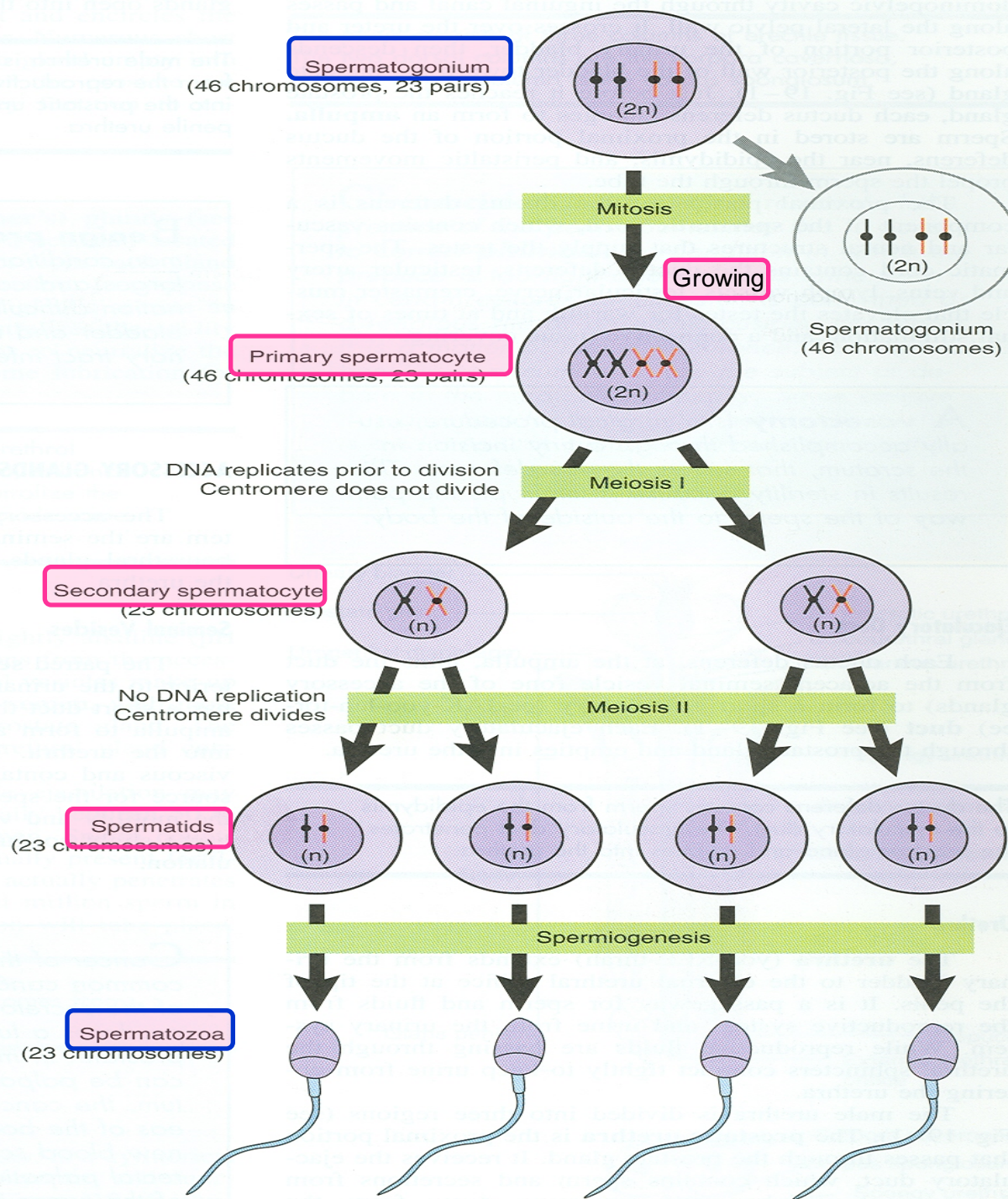
# SPERMATOGENESIS



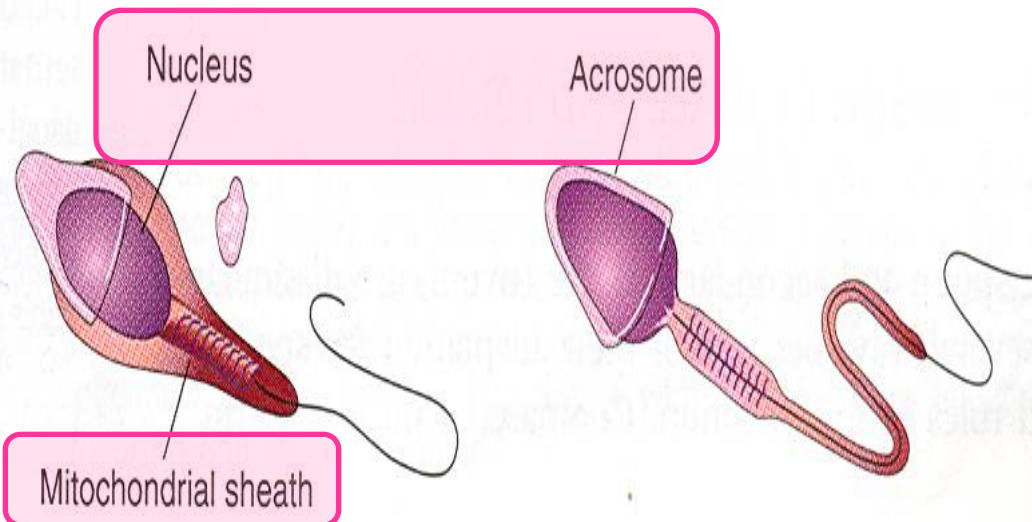
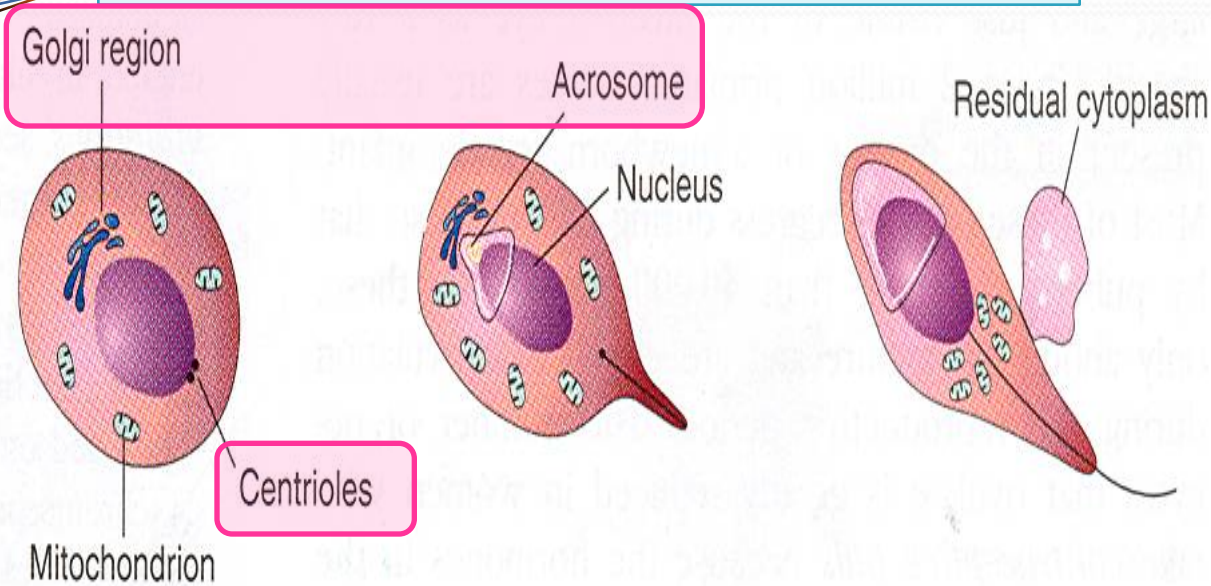
- **AIM:**
- Formation of sperms with haploid number of chromosomes.
- **SITE:**
- **Seminiferous tubules** of the testis.
- **TIME:**
- From puberty till old age.
- **DURATION:**
- **About two months**
- **N.B. Sperms are stored and become functionally mature in the Epididymis.**

# SPERMATOGENESIS

- Each **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 **2<sup>nd</sup> meiotic division** to form **4 haploid spermatids** (half size).
- **Spermatids** are transformed into **4 mature sperms** by a process called **spermiogenesis**.



# SPERMIOGENESIS

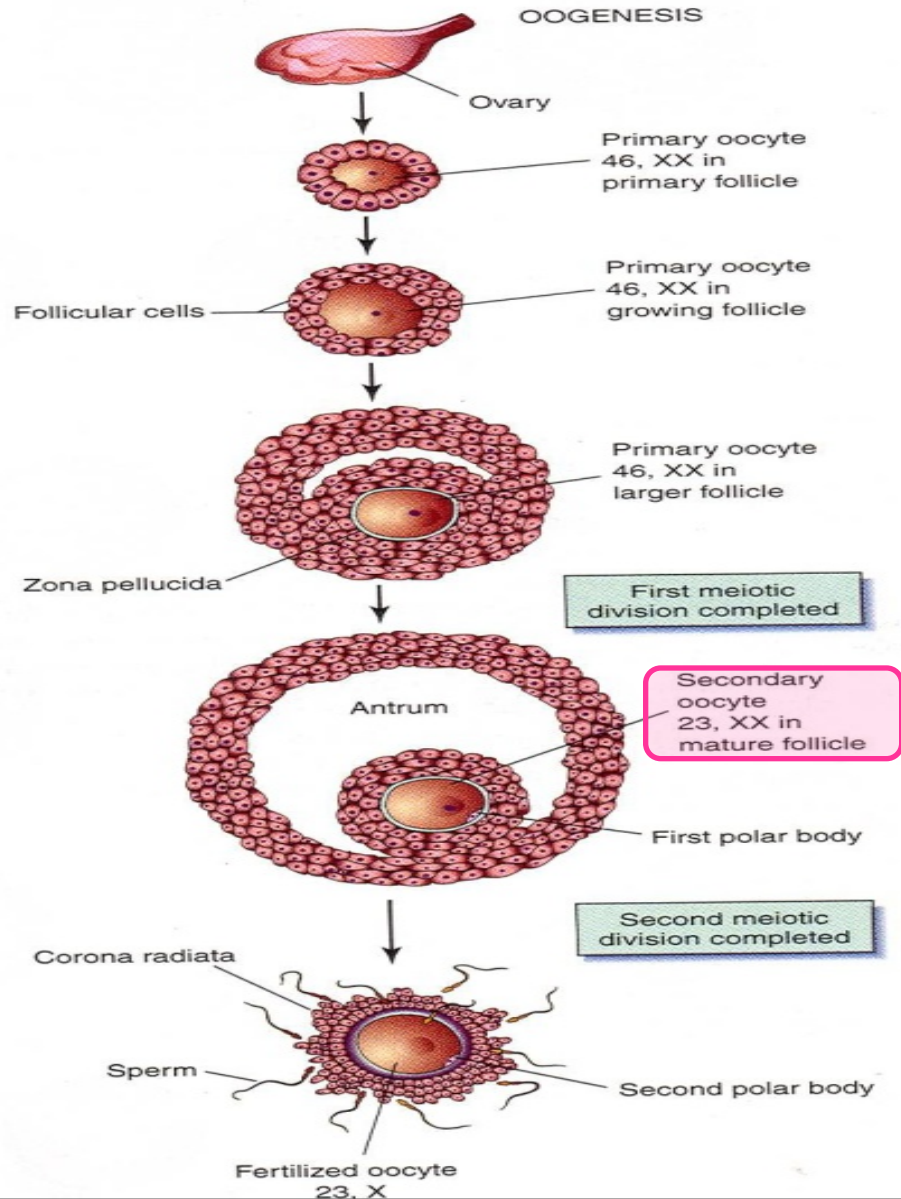


- It is *change in shape (metamorphosis) through which Spermatids are transformed into mature Sperms*:

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.*

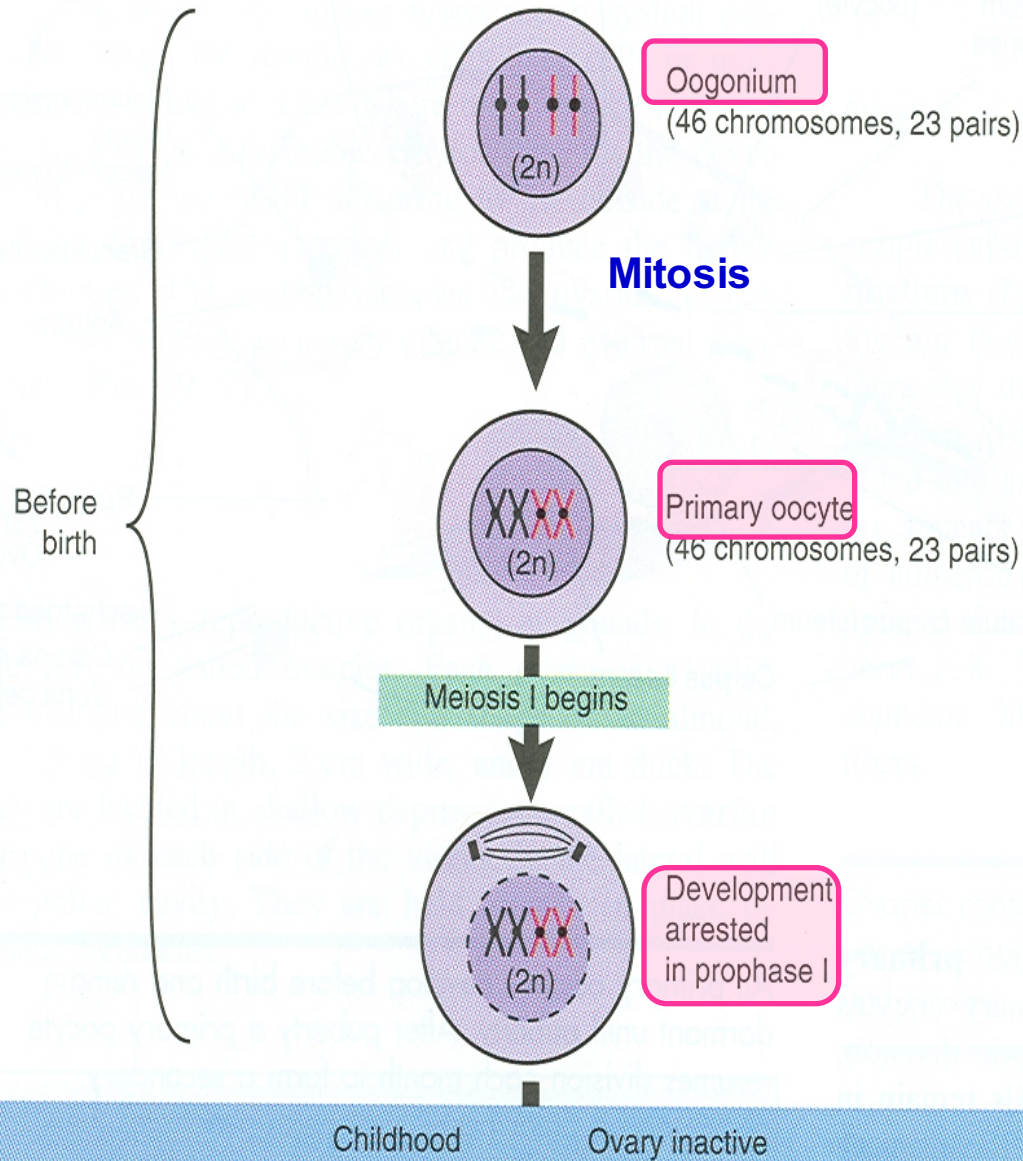


# OÖGENESIS



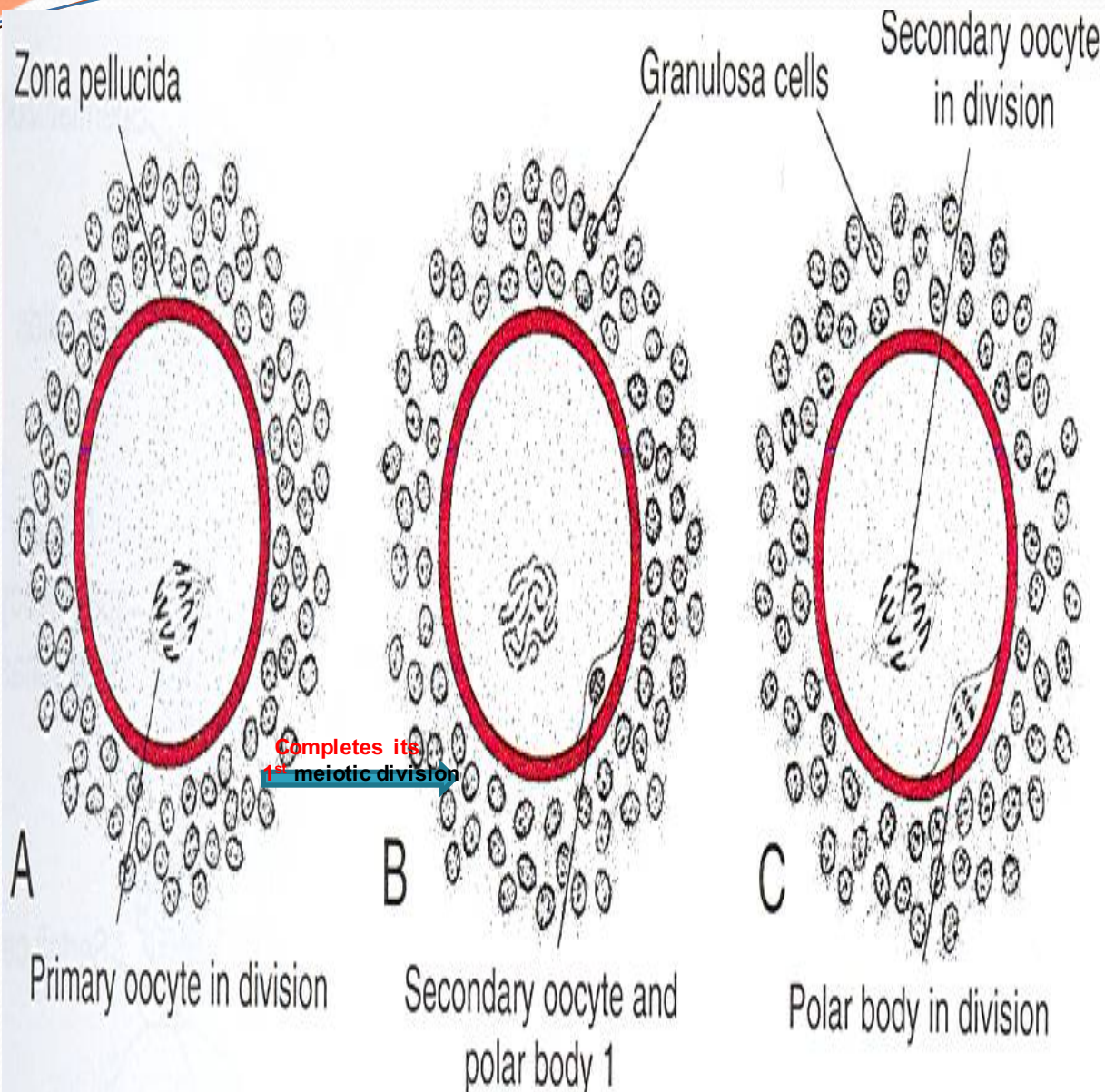
- **AIM:**
- **Formation of secondary oocytes with haploid number of chromosomes.**
- **SITE:**
- **Cortex of the ovary**
- **TIME:**
- **Starts during fetal life becomes completed after puberty & continues until menopause.**
- **It occurs monthly Except during pregnancy.**

# O O G E N E S I S



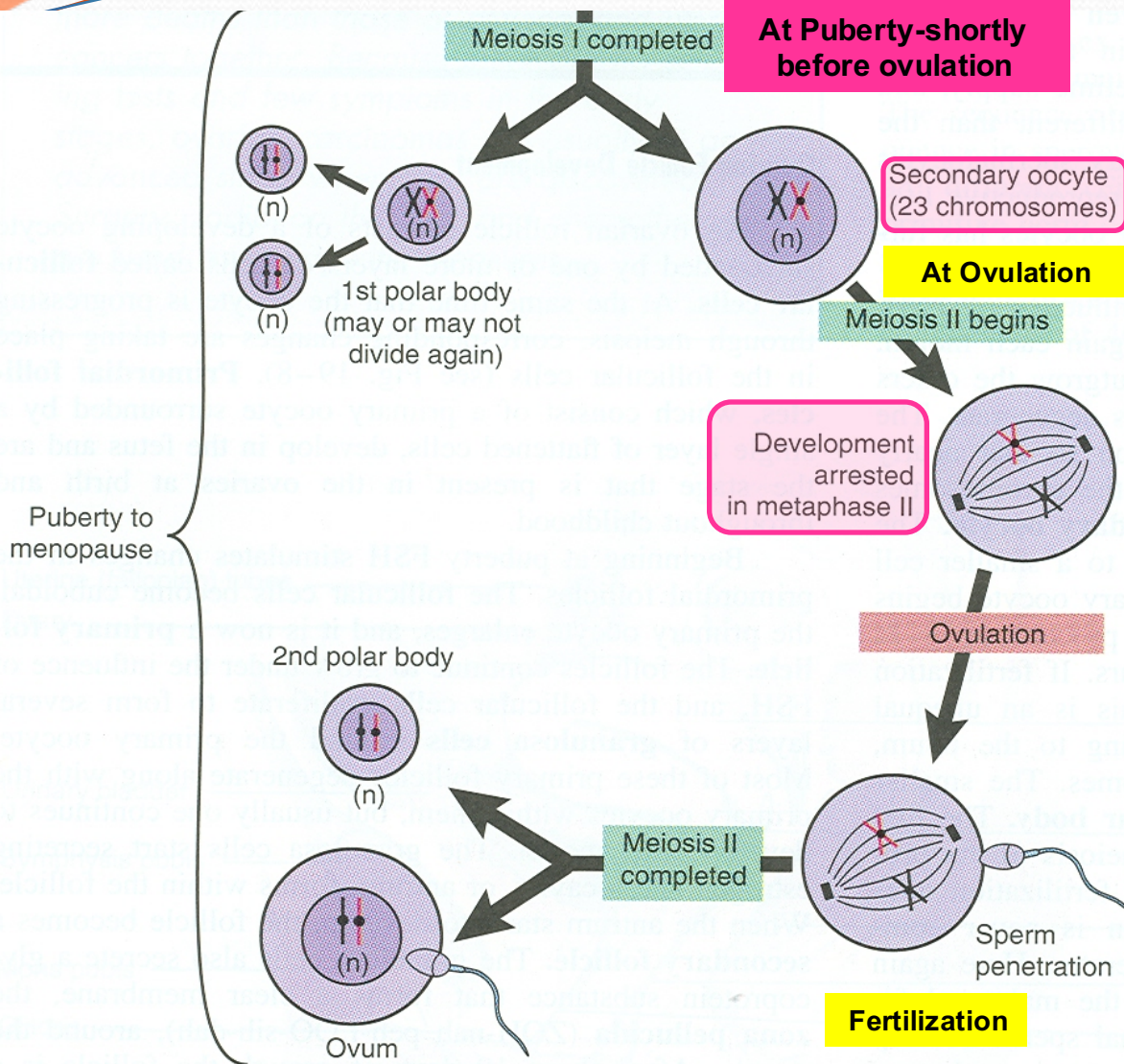
- **Before Birth:**  
(During early fetal life)  
, primitive ova  
(**Oogonia**). proliferate  
by mitotic division and  
enlarge to form **Primary  
Oocytes (46)**
- **Before and At Birth :**  
**all primary oocytes**  
completed the **prophase**  
of the **1<sup>st</sup> meiotic**  
**division** and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

# O O G E N E S I S



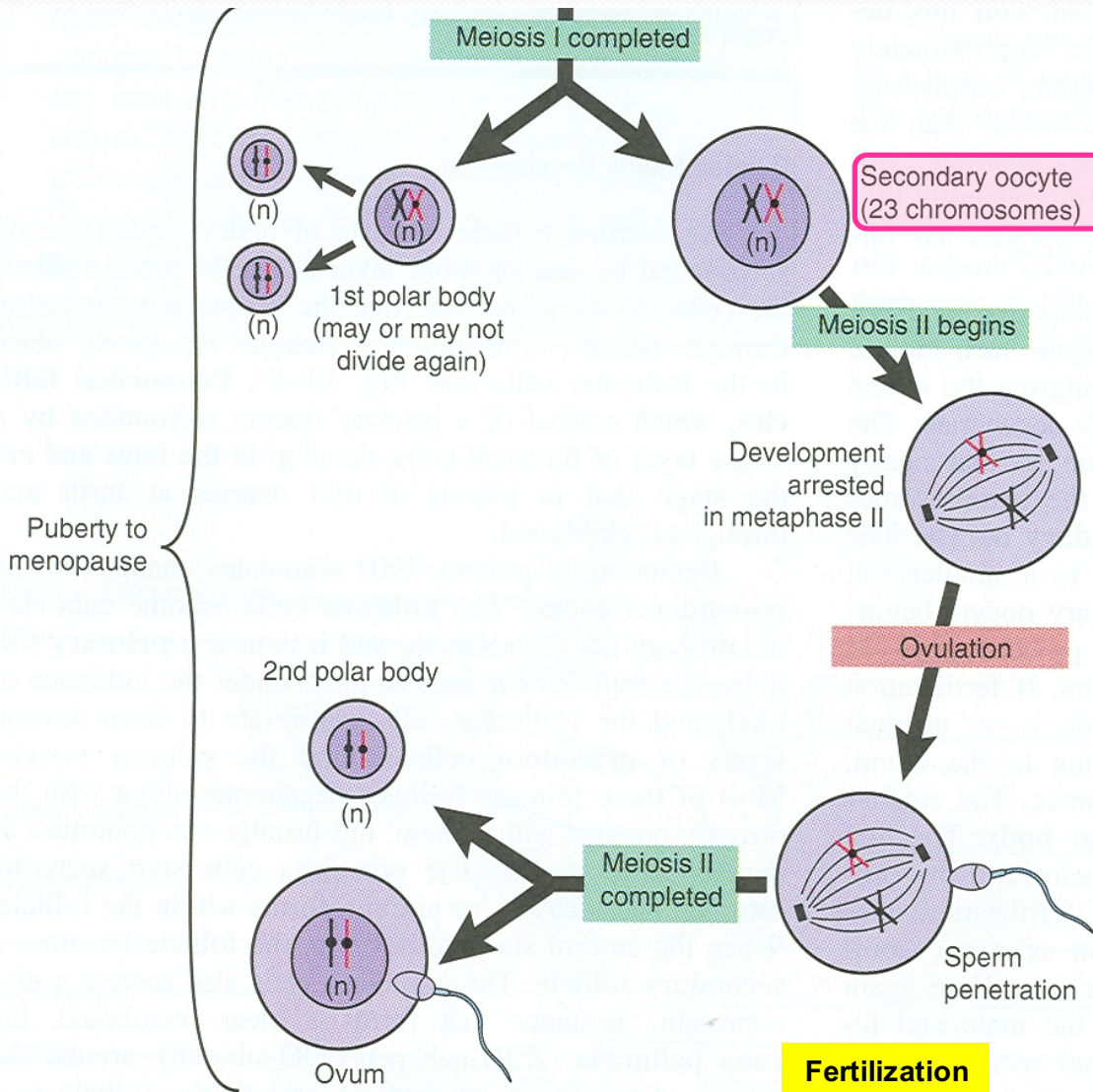
- At Puberty
- Shortly before ovulation, the Primary Oocyte completes its first meiotic division to give Secondary oocyte (23) & First Polar Body.
- The Secondary Oocyte receives almost all the cytoplasm.
- The First Polar Body receives very little.
- It is small nonfunctional cell that soon degenerates.

# 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 (Fertilized Oocyte)**.
- The rest is in the **2<sup>nd</sup> 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 1<sup>st</sup> meiotic division which stops at prophase

## AFTER PUBERTY DURING EACH OVARIAN CYCLE

1<sup>st</sup> meiotic division is completed: (shortly before ovulation):

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

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

## AFTER FERTILIZATION

2<sup>nd</sup> meiotic division is completed:

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

**N.B.: NO PRIMARY OOCYTES FORM AFTER BIRTH**



**GOOD  
LUCK**