

FEMALE REPRODUCTIVE SYSTEM

PAPER- CC13, SEM- 6

Female Reproductive System

- Produce sex hormones
 - Estrogen, Progesterone
- Produce egg (ova)
- Support & protect developing embryo
- Give birth to new baby

Major Organs



- ❑ Cervix
- ❑ Vagina
- ❑ Ovaries [gonads]
- ❑ Uterine tubes [fallopian tubes]
- ❑ Uterus

Out line:

- Introduction
- Definition
- Characteristics of normal menstruation
- The hypothalamic-pituitary-ovarian axis
- Ovarian cycle
- Menstrual cycle
- Menstrual abnormalities
- Comfort measures during menstruation

Introduction

- Typically, a woman of childbearing age or reproductive age (**15-45**) should menstruate every 28 days or so **unless she's pregnant or moving into menopause**. But numerous things can go wrong with the normal menstrual cycle. The menstrual cycle is essential for the production of eggs, and for the preparation of the uterus for pregnancy

Note The flow of menses normally serves as a sign that a woman has not become pregnant. (However, this cannot be taken as certainty, as a number of factors can cause bleeding during pregnancy)

Definition:

- **Menstruation** means cyclic uterine bleeding caused by shedding of progesterational endometrium it occurs between **menarche** and **menopause**
- **Menstruation** (also called **menstrual bleeding, menses, or a period**)

Characteristics of normal menstruation

- 1-Menarche: **10-16** years. average **13** years.
- 2-Duration: **2-7** days (<2days is **hypomenorrhea** and >7 days is **menorrhagia**)
- 3-Amount: 30-80 ml., uses 3 napkins per day, >80 ml. is **menorrhagia** and < 30 ml. is **hypomenorrhea**.

Note Factors such as heredity, diet and overall health can accelerate or delay menarche

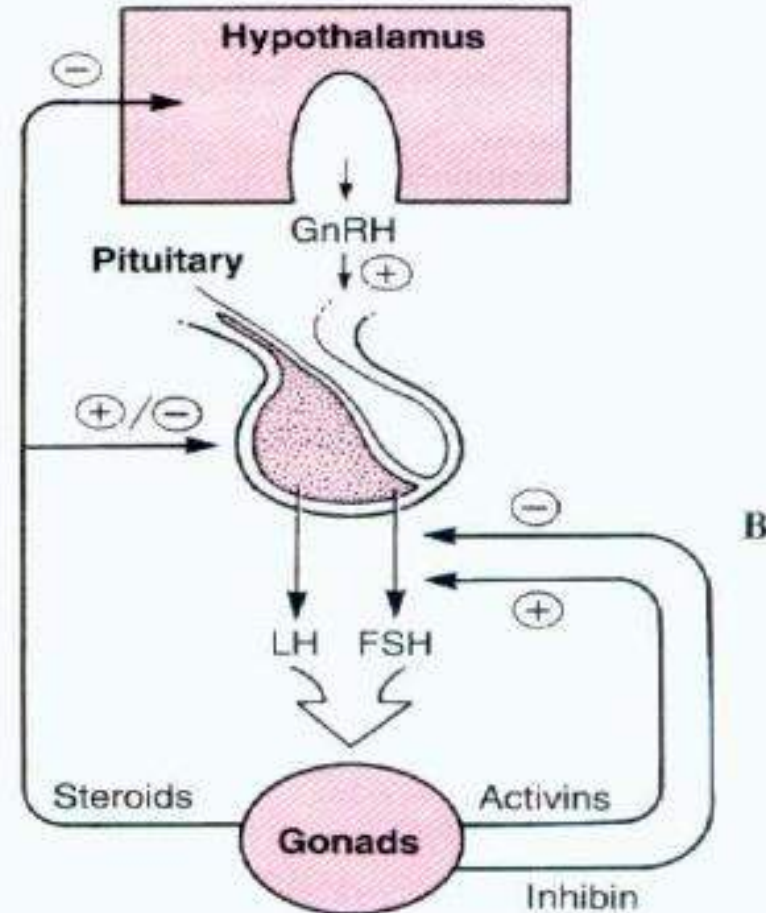
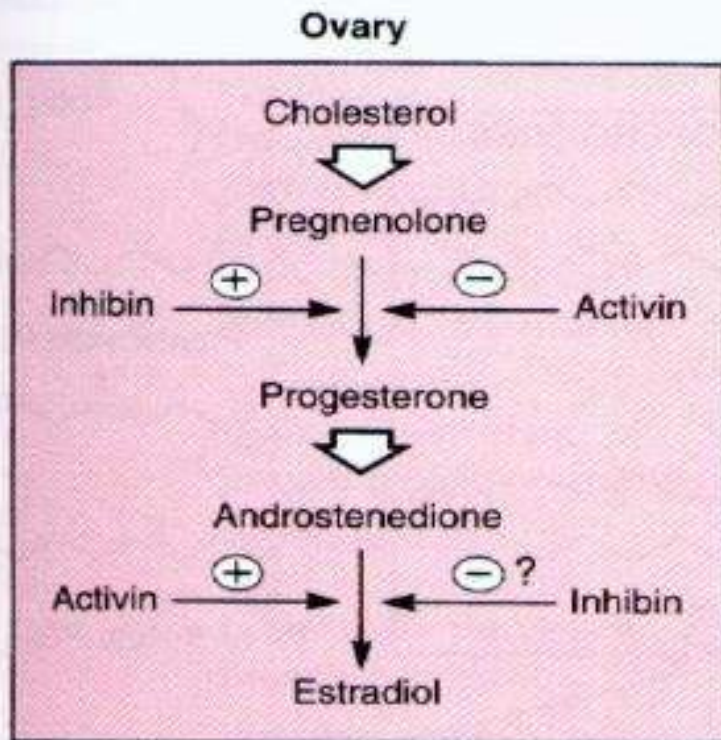
:length variation between eight and 20 days in a woman is considered as moderately **irregular menstrual cycles**. Variation of 21 days or more is considered very irregular

- 4-Normally menstrual blood doesn't coagulate as a result of secretion of **fibrinolysin enzyme (plasmin)** secreted by the endometrium.
- 5-Menstrual **molimina** refers to mild symptoms of **7-10** days before menstruation relieved once menstruation occurs exaggerated condition called (**premenstrual syndrome**).

The hypothalamic-pituitary-ovarian axis:

- There Are **two** main components of the menstrual cycle, the **changes** that happen in the **ovaries** in response to pituitary hormones (the ovarian cycle)
- and the **variations** that take place in the **uterus**, but it is important to remember that **both cycles work together simultaneously** to produce the menstrual cycle.
- **Changes in cervical mucus** also take place during the course of the menstrual cycle.

HYPOTHALAMIC- PITUITARY- OVARIAN AXIS



The Cycle



- Strongly linked to the endocrine system (hormone based and paracrine based)
- Typically takes 28 days to cycle through 4 phases
 - Follicular
 - Ovulation
 - Luteal
 - Menstruation
- Hormones raise and fall

Ovarian Cycle:

- The ovarian cycle **refers** to Periodic changes that occur in the ovary every month during the ♀ reproductive life.
- Cyclical changes in the ovaries occur in response to **two anterior pituitary hormones:**
- ***Follicle-stimulating hormone(FSH)***
- ***Luteinizing hormone (LH).***

Ovarian follicular development

- Fetus: 6-7 million in 20 wks.
- At birth: 1-2 million
- At puberty: 300,000
- Release during ovulation: 400-500
- At menopause: rare

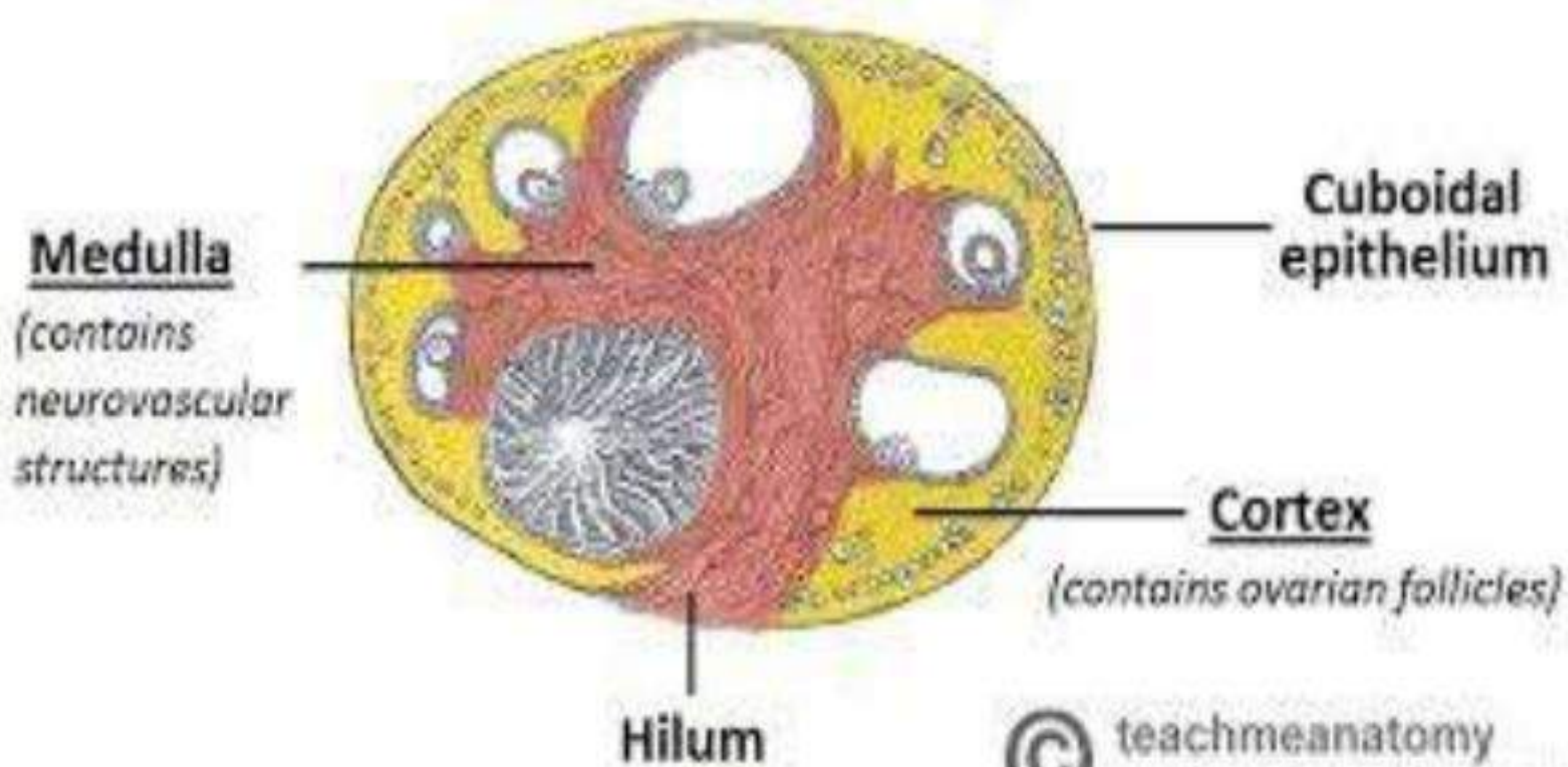
Oogenesis

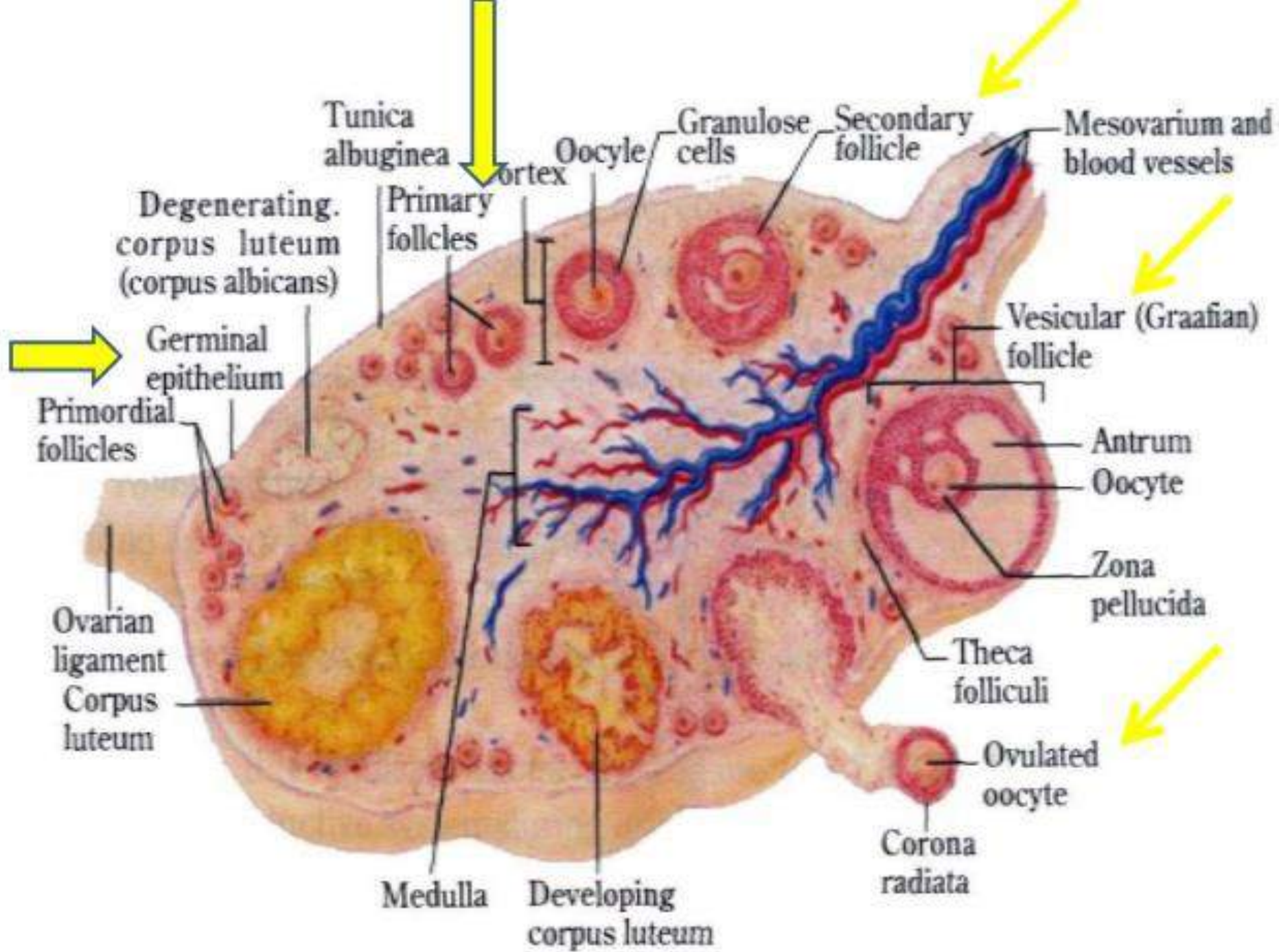
Process of formation and maturation of **ova** is called oogenesis.

Ova is formed from cells of germinal epithelium lining the **ovary**

Larger germinal cells with bigger nucleus are called **PRIMORDIAL GERM CELLS**

Involves production of **haploid nucleus** as well acquisition of **food reserves** and preliminary organization of **cytoplasm**





The Ovary

Solid Organ

Attached by its antero lateral border to the broad ligament, in an area called HILUS

Stroma consist of tissue of broad ligament

- Consists of **Cortex** and **Medulla**

Free surface is covered with surface epithelium (cuboidal in young women, flattens with age)

Stroma

Cortex

Occupies major part of ovary

Primitive connective tissue having spindle shaped fibroblast cells

Fine collagenous and reticular fibres are found in between

It contains

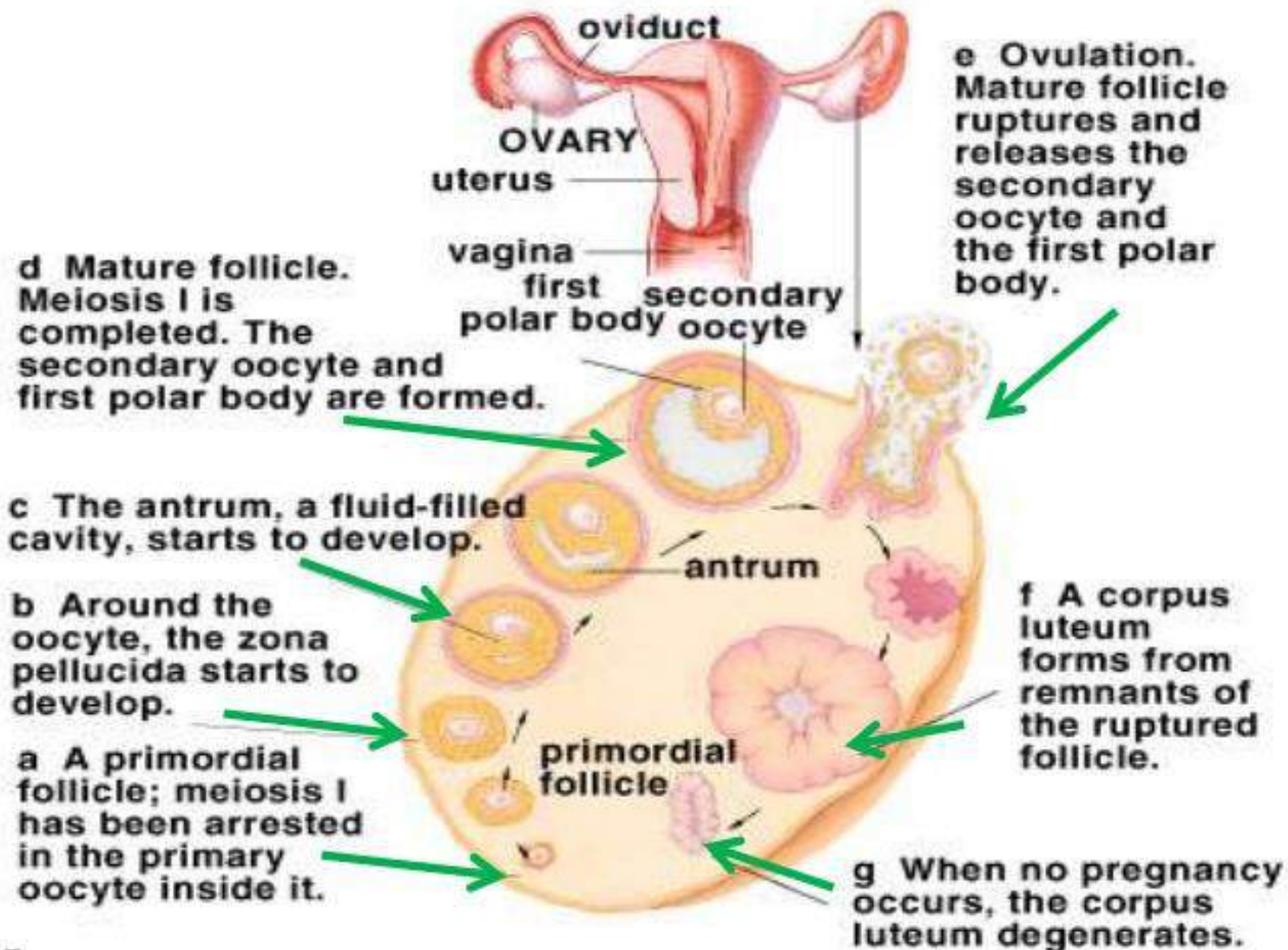
- Graffian follicle
- Corpus leuteum
 - Corpus leuteum of mensuration
 - Corpus Albicans
 - Corpus leteum of pregnancy or corpus luteum vertum
- Atretic Follicles

Medulla

Vascular and fibrous core

Abundant blood vessels

Medulla merges with mesovarium at hilus



Graafian Follicle:

- The **Graafian follicle** is the follicular stage after the first meiotic division but before ovulation. It therefore contains a 2N haploid oocyte.

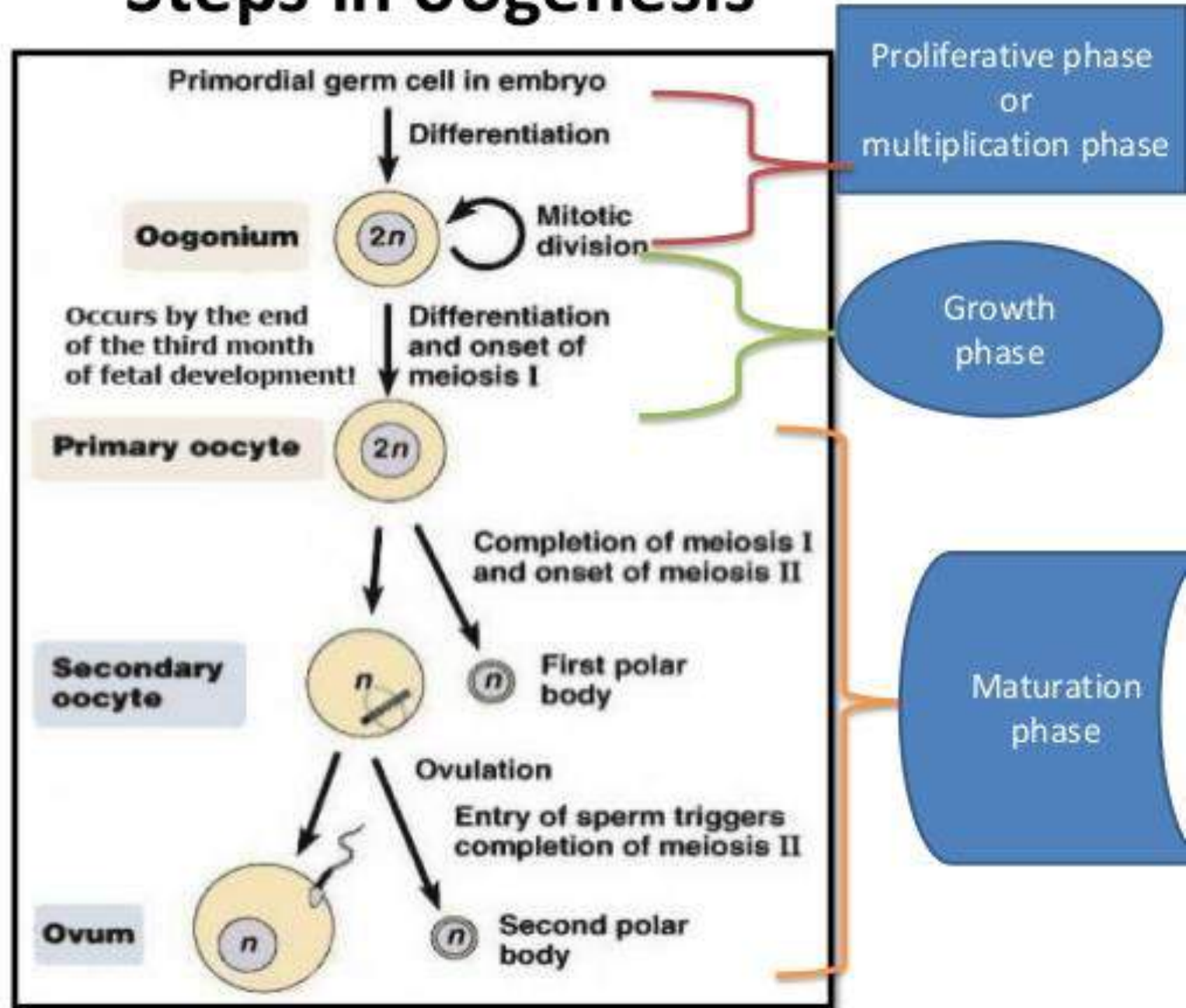
Corpus luteum

- Contains transformed discharged follicles.

Atretic follicles

- degenerating follicles

Steps in oogenesis



○ There are 5 stages of oogenesis process

1. The germinal epithelial cells divide repeatedly until many **diploid oogonia** are formed.
2. The oogonia grow to form **primary oocytes** that surrounded by a layer of follicle cells.
3. The oocytes undergoes the first meiotic division to become a **secondary oocyte and a first polar body.**(haploid)

4. The follicle cells surrounding the primary follicle develop into the **secondary follicle.**
–The follicle layer of the secondary oocyte thickens and folds to form the Graafian follicle

–When the Graafian follicle become matures,it will move towards the surface of the ovary wall and rupture to release the secondary oocyte(n).

NUTRITIVE CELLS

Growing oocyte is surrounded by two types of nutritive cells

- Follicle cells
- Nurse cells

Follicle cells

Found in mammals and in some vertebrates

Surrounds oocytes during growth and maturation phase

Derived from germinal epithelium cells of ovary

Initially a single layer of follicle cells, later converts into multiple layer

Follicle cell + developing oocyte = GRAAFIAN FOLLICLE

As egg approaches maturity, and ecentric cavity called ANTRUM appears in the mass of follicle cells

ANTRUM is filled by LIQUOR FOLLICULI secreted by follicle cells

Plasma membrane of oocyte and follicle cells are seperated by a gap of 80 Angstrom, but connected by desmosomes

later, this gap widens surface of young oocyte is drawn into microvilli. These occupy space between oocyte and follicle cells.

- Zone of microvilli appears as SONA RADIATA

Follicle cells secrete substances which are taken up by oocytes (cell drinking / pinocytosis)

Maturation phase

- The primary oocytes undergoes the first meiotic division to produce two haploid cells.
- Since there is an unequal division of the cytoplasm, one of the cells is large and receives most of the cytoplasm (secondary oocytes) and other is small (Secondary oocytes).
- Ovulation occurs in secondary oocyte stage.
- The second part of the meiosis take place only after the contact of sperm.
- The nucleus of secondary oocytes divides again to form another polar body and Ootid.
- As there is no metamorphosis in Ootid, it may be called as Ovum.

Stages in oogenesis

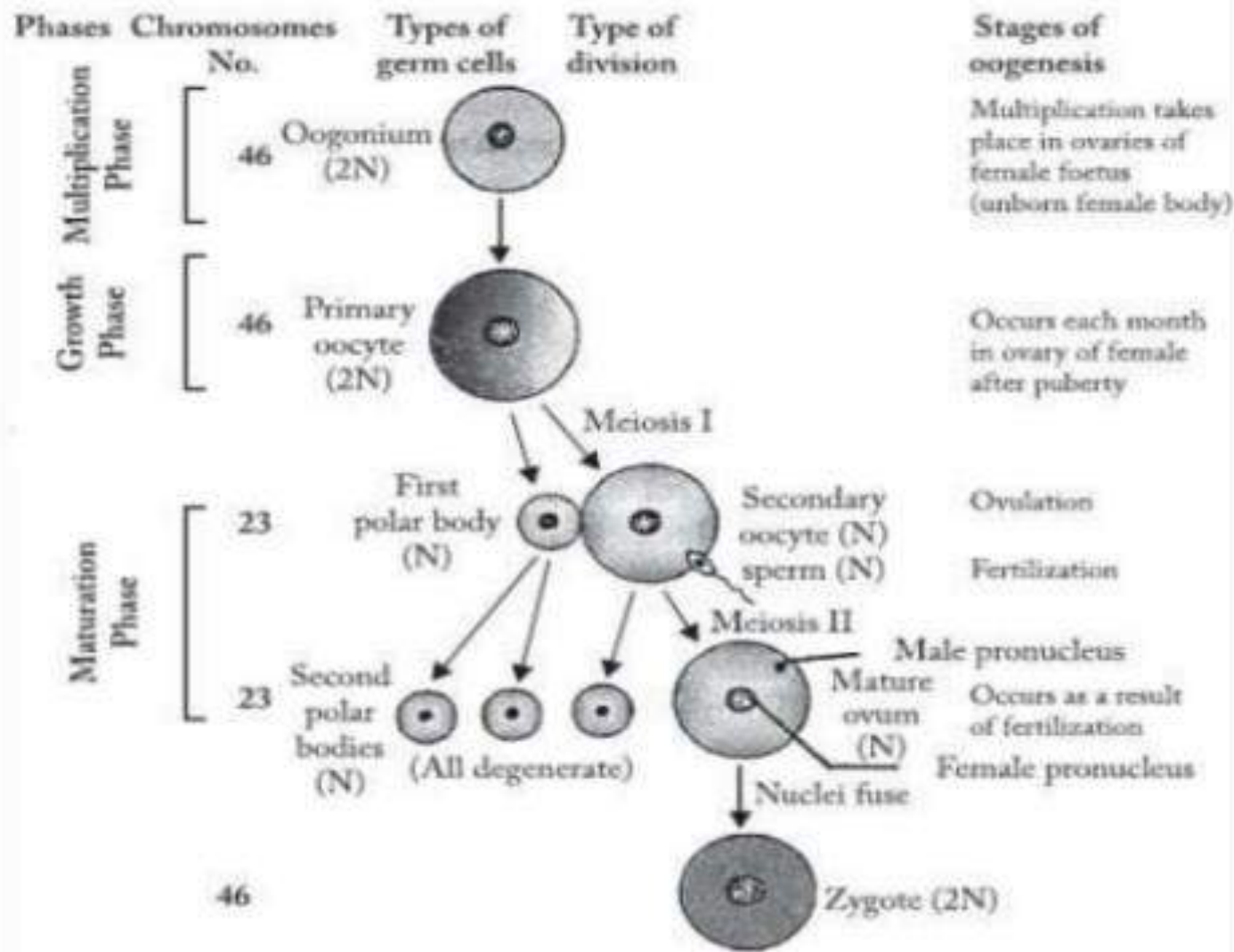
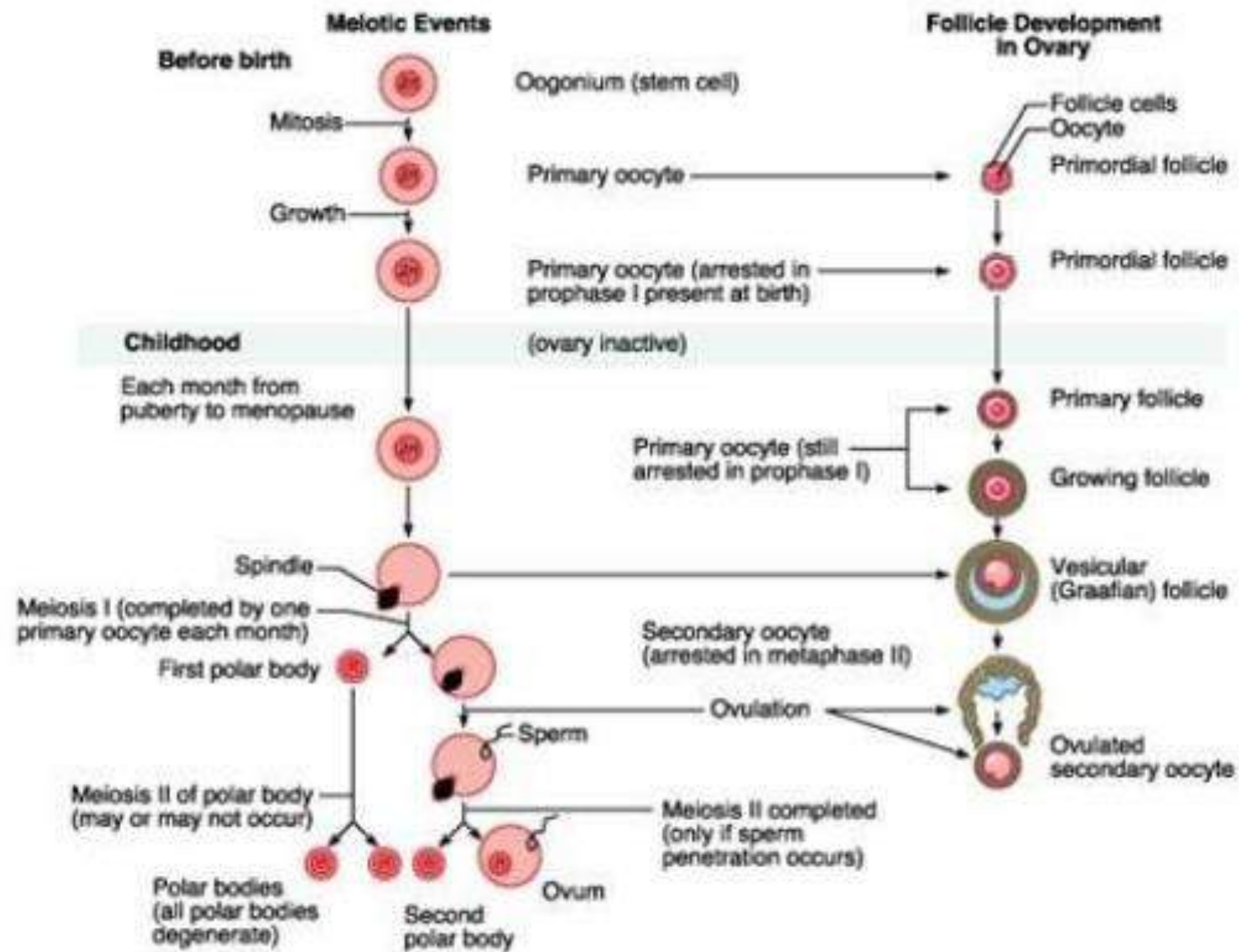
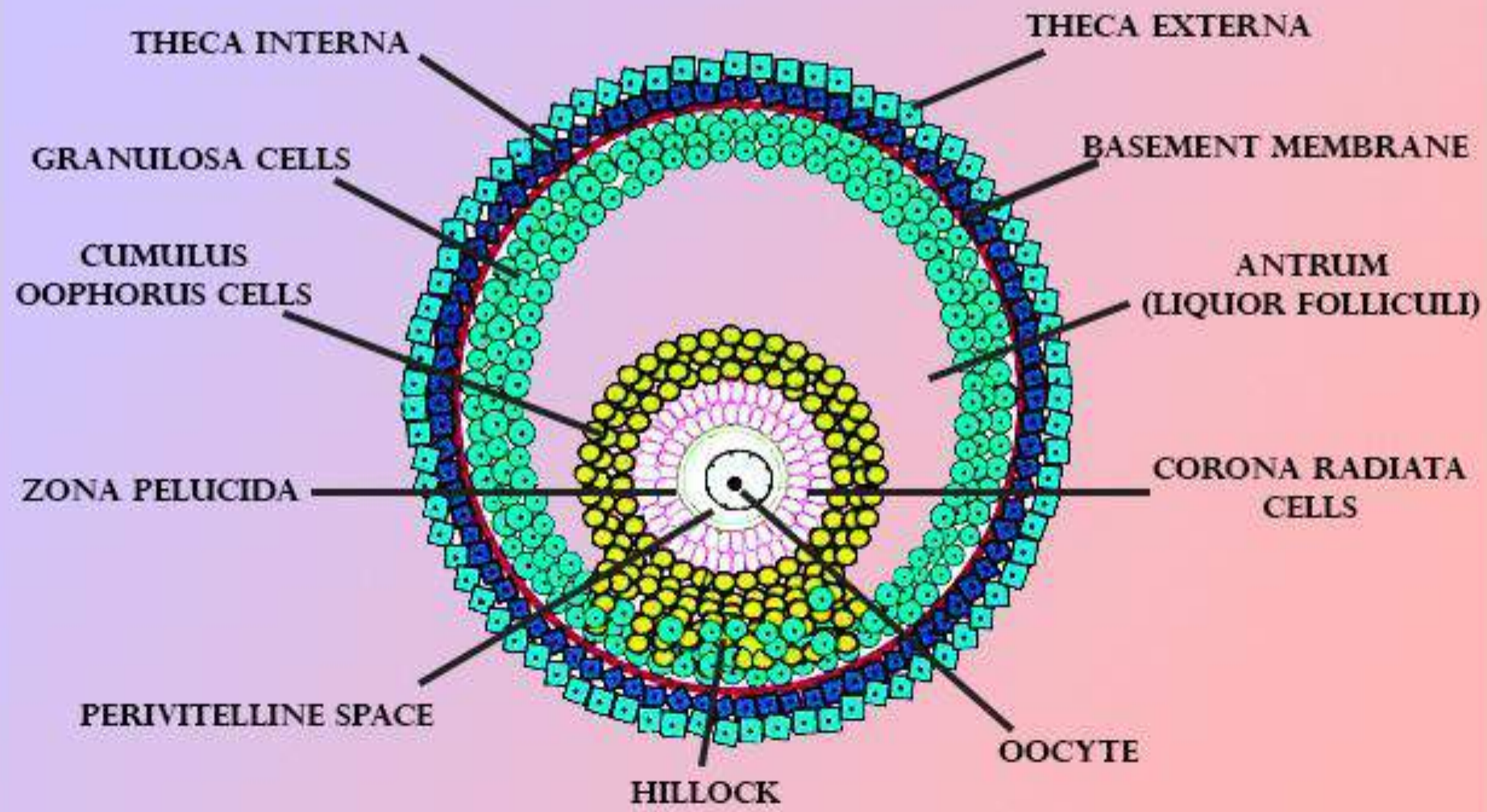


Fig.: Stages in oogenesis.



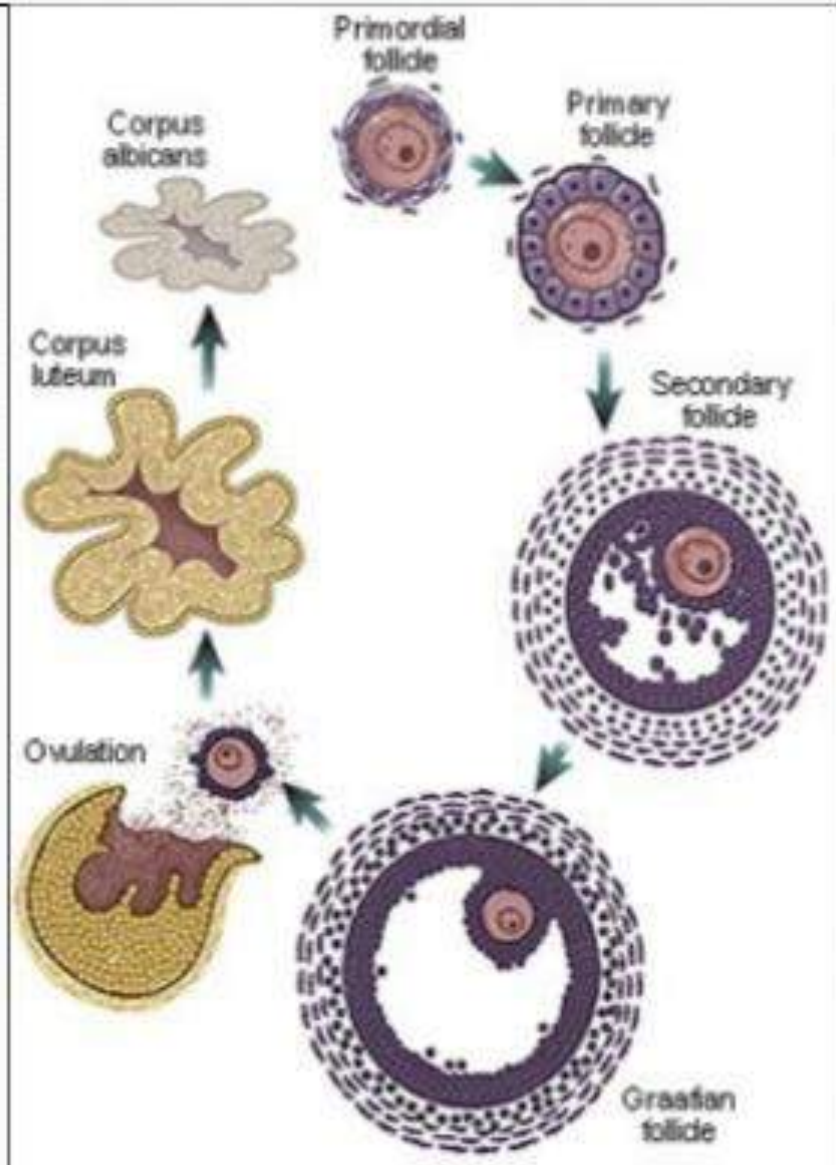
GRAFFIAN FOLLICLE

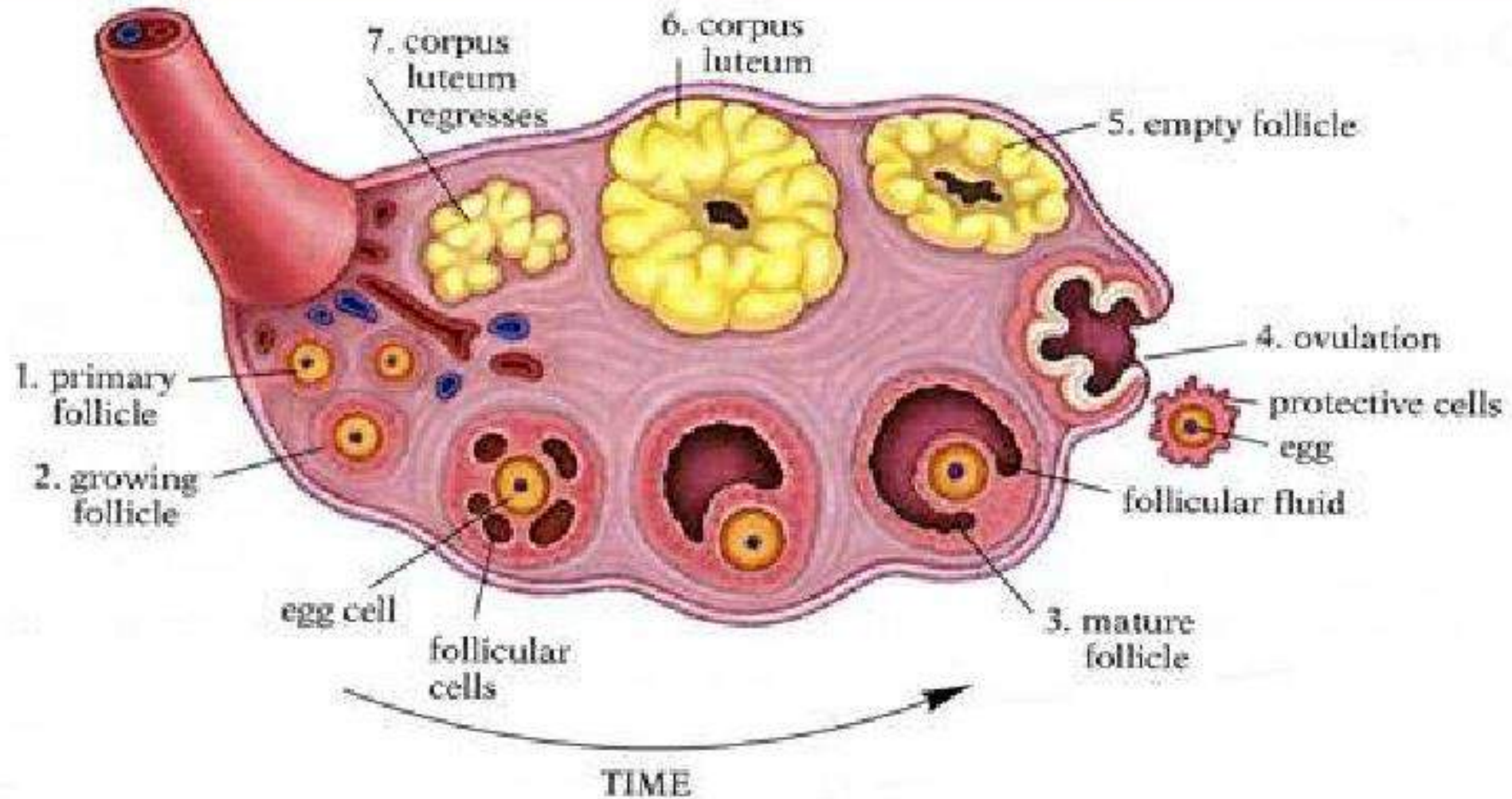


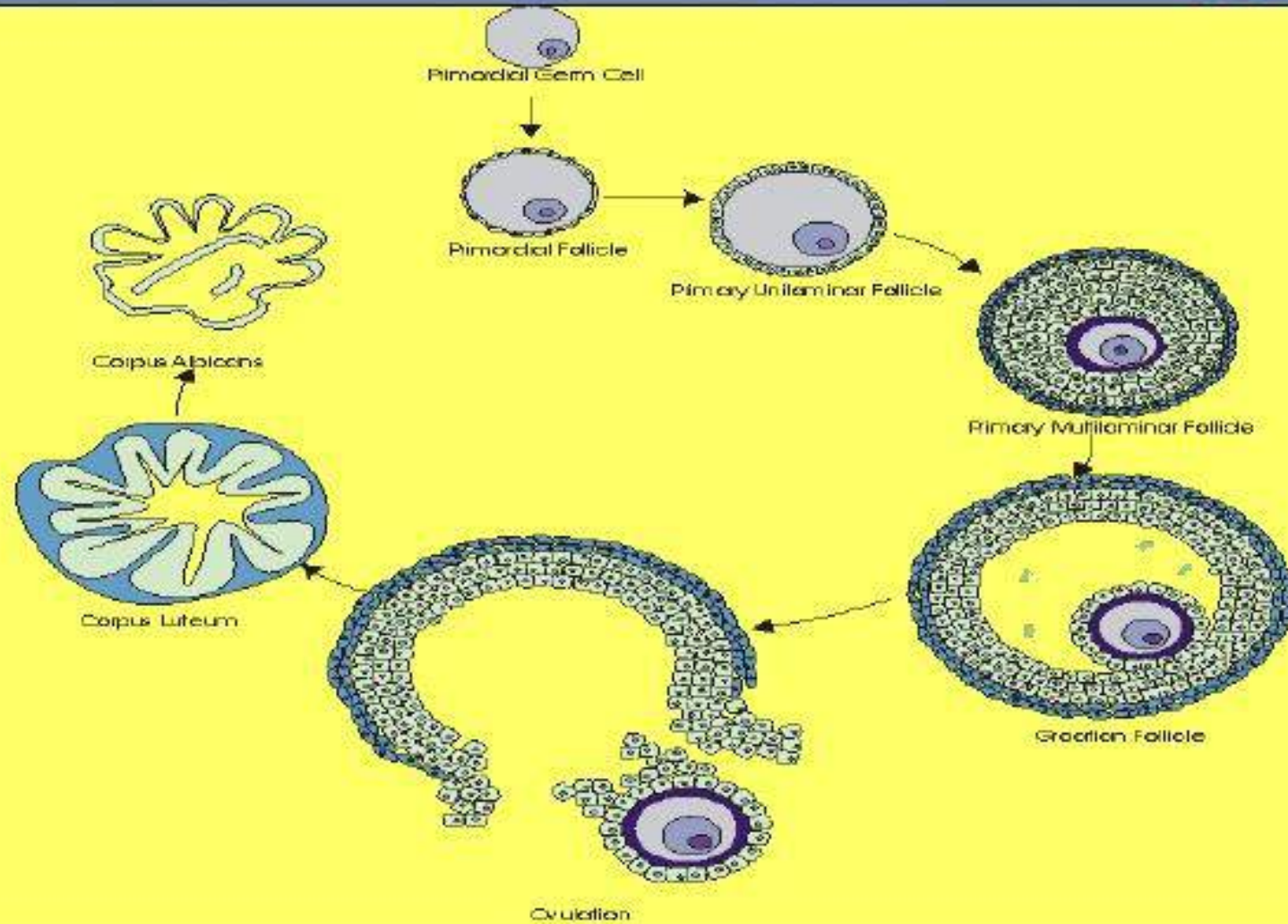
The changes that occur in the ovary during each cycle can be divided into three phases:

- 1) Follicular phase (day 1-13)
- 2) Ovulatory phase (day 13-15)**
- 3) The luteal phase (day 15-28).

These phases run in parallel with the phases of the uterine cycle and together comprise the menstrual cycle.

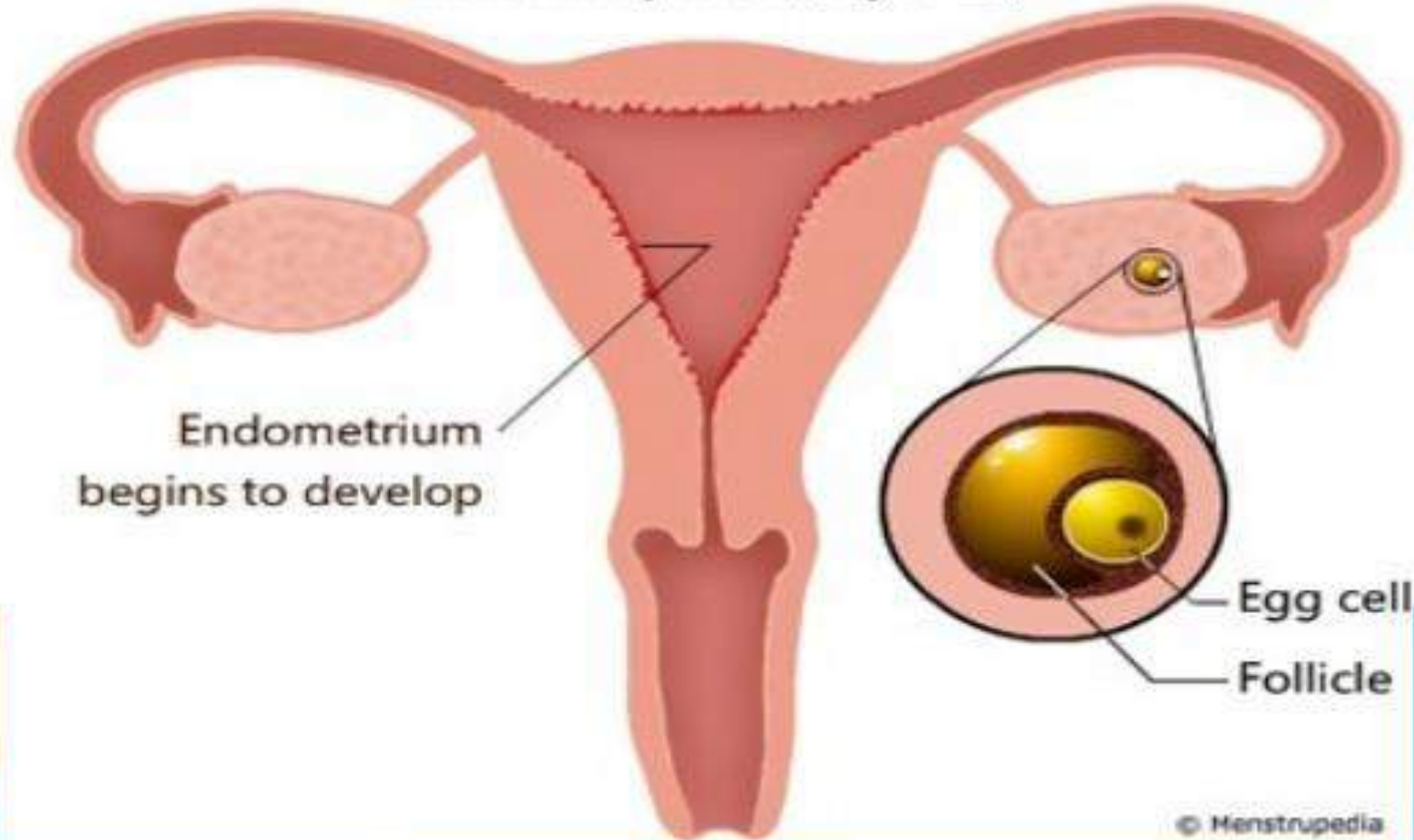


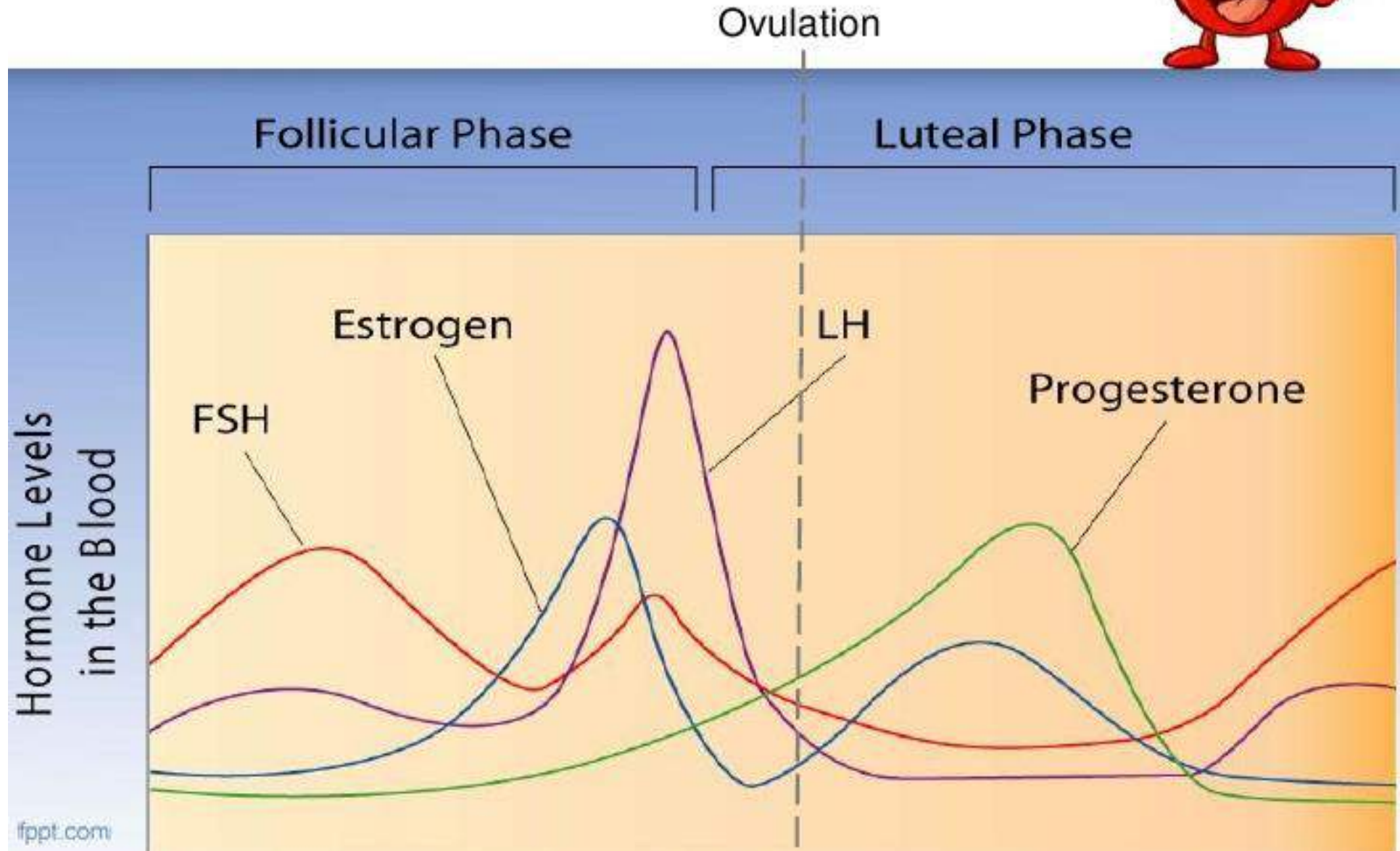




:FOLLICULAR PHASE-1

Follicular phase (day 1-13)



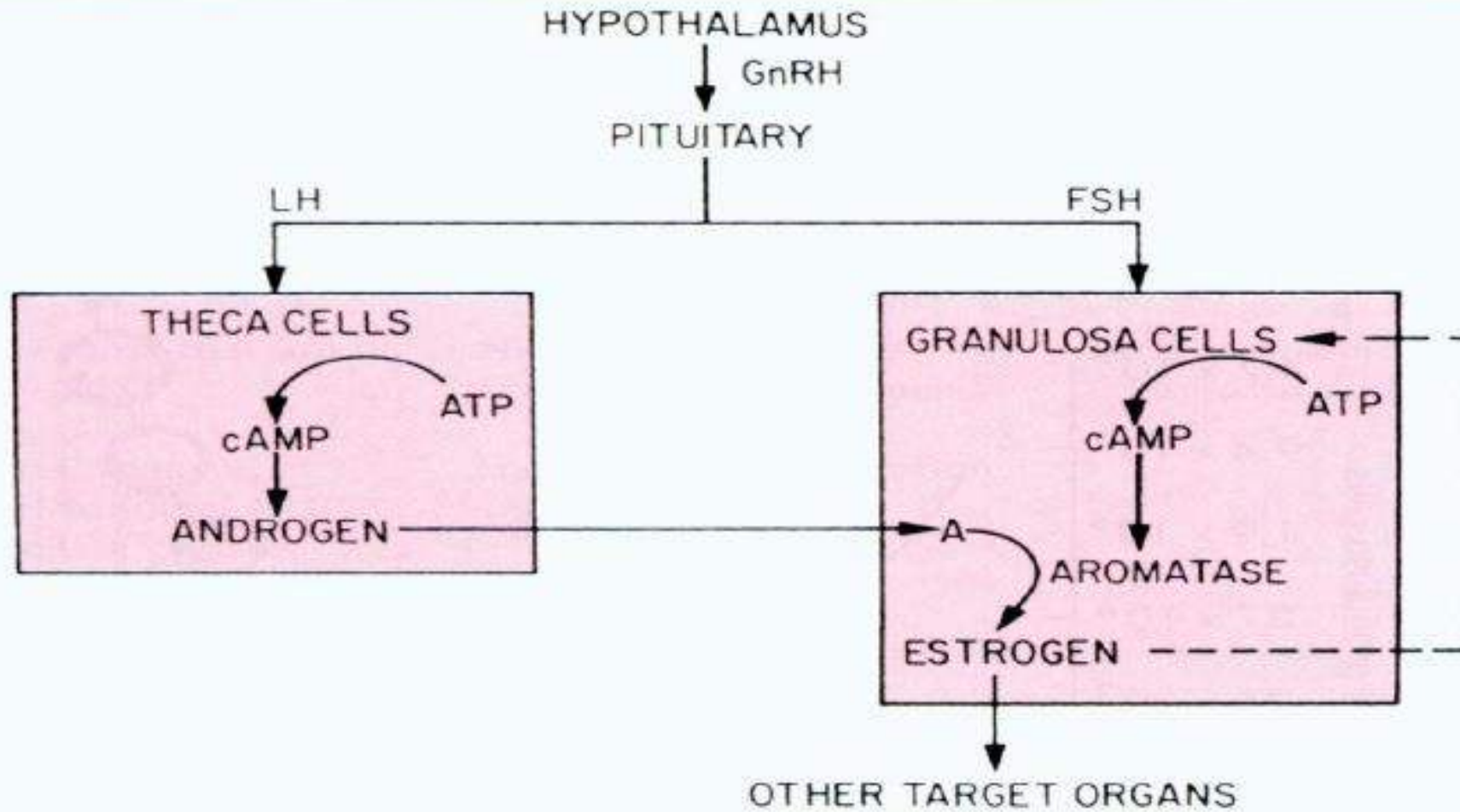


- At the beginning of each menstrual cycle, the **hypothalamus** secretes -----< **GnRh** in a pulsatile manner to stimulate ----< **ant. Pit. gland** to secrete -----< **FSH & LH**.
- **FSH** is responsible for the growth of several primary follicle
- The follicular phase is controlled by **FSH**, encompasses days **1** to **13** of a 28-day cycle.

● only one follicle on **one** of the ovaries reaches maturity (**graafian follicle**) which secretes **oestrogen**.

- ❑ Estrogen has negative feedback on the pituitary to stop FSH
- ❑ Estrogen causes the uterine lining (endometrium) to grow thicker

TWO CELL THEORY



FOLLICULOGENESIS (3)



OTHER FACTORS THAT PLAY A ROLE IN FOLLICULOGENESIS

-INHIBIN

- Local peptide in the follicular fluid
- -ve feed back on pituitary FSH secretion
- Locally enhances LH-induced androstenedione production

-ACTIVIN

- Found in follicular fluid
- Stimulates FSH induced estrogen production
- ↑ gonadotropin receptors
- ↓ androgen
- No real stimulation of FSH secretion in vivo (bound to protein in serum)

PREOVULATORY PERIOD



NEGATIVE FEEDBACK ON THE PITUITARY

- ↑ estradiol & inhibin ⇒ -ve feed back on pituitary ⇒ ↓ FSH
- This mechanism operating since childhood

POSITIVE FEEDBACK ON THE PITUITARY

- ↑ ↑ estradiol (reaching a threshold concentration) ⇒ ⇒ +ve feed back on the pituitary (facilitated by low levels of progesterone) ⇒ ⇒ LH surge ⇒ secretion of progesterone
- Operates after puberty
- +ve feed back on pituitary ⇒ ↑ FSH

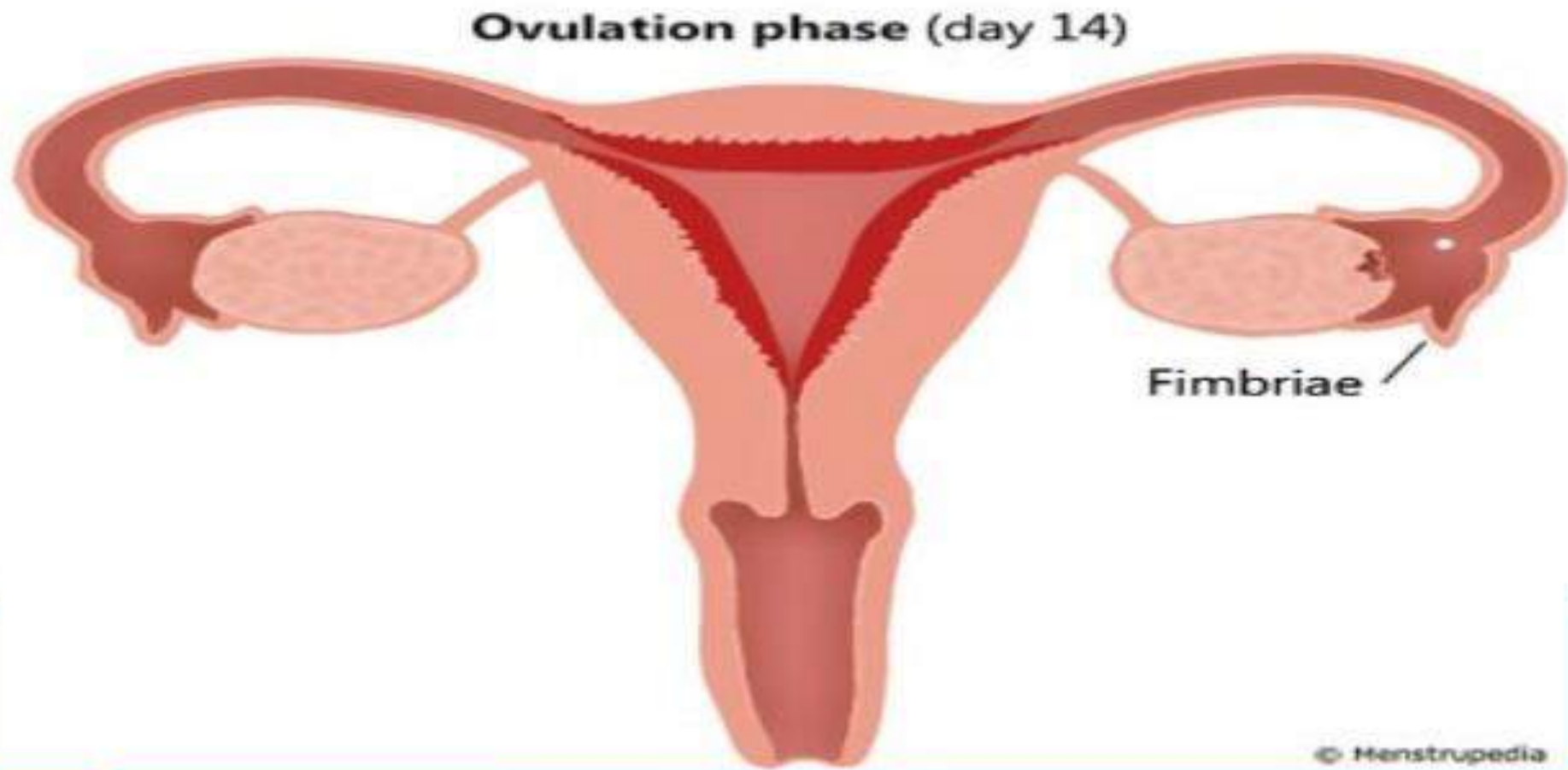
PREOVULATORY PERIOD



LH SURGE

- Lasts for 48 hrs
- Ovulation occurs after 36 hrs
- Accompanied by rapid fall in estradiol level
- Triggers the resumption of meiosis
- Affects follicular wall \Rightarrow follicular rupture
- Granulosa cells \Rightarrow lutenization \Rightarrow progesterone synthesis

2- ovulatory phase



- The **estrogen** peak stimulates secretion of **LH**.
The **LH** peak leads to :
 - The **follicle** to **burst open**, releasing the **mature ovum** into the abdominal cavity a process called (**ovulation**). and **corpus luteum** formation.
 - Ovulation occurs **on day 14** of a 28-day cycle.

Note : High **estrogen** also suppress **FSH** secretion so no further follicles grow

3-Luteal phase:

4

Luteal phase



- After ovulation, **LH** levels remain **elevated** and cause the remnants of the follicle to develop into a yellow body called the **corpus luteum**.
- + In addition to producing **oestrogen**, the corpus luteum secretes a hormone called **progesterone**.

- when **progesterone** reaches a **high level** it inhibits the secretion of **LH** leads
 - degeneration of the corpus luteum (If fertilization does not take place),
 - and so oestrogen and progesterone drop & separation of the endometrium (**menstruation**) & stimulates the hypothalamus to secrete more **GnRH**, a new cycle is started.

1 Menstrual phase



2 Follicular phase



4 Luteal phase



3 Ovulation phase



Phases of Menstrual cycle

II -Uterine Cycle:

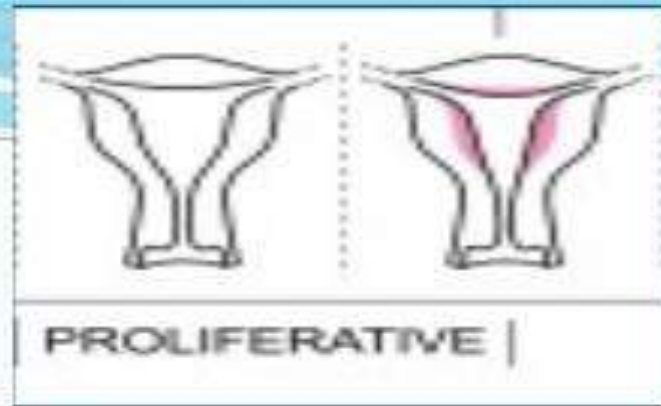
- The uterine cycle refers to the changes that are found in the uterine lining of the uterus. These changes come about in response to the ovarian hormones estrogen and progesterone. There are **4** four phases to this cycle:
 1. **Menstrual,**
 2. **proliferative,**
 3. **secretory and**
 4. **ischemic.**

1-Menstrual Phase



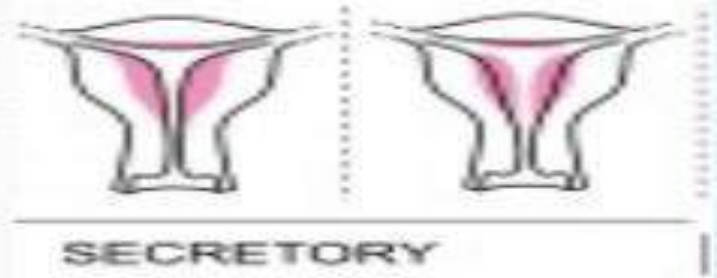
- Day **1** of the menstrual cycle is marked by the onset of menstruation. During the menstrual phase of the uterine cycle, the uterine lining is shed because of **low levels of progesterone & estrogen**. At the same time, a follicle is beginning to develop and starts producing. The menstrual phase **ends** when the menstrual period stops on approximately day **5**.
- **Duration 1-5 days**

2-Proliferative Phase



- When **estrogen** levels are **high** enough, the endometrium begins to regenerate.
- **Estrogen** stimulates blood vessels to develop. The blood vessels in turn bring nutrients and oxygen to the uterine lining, and it begins to grow and become thicker.
- The proliferative phase **ends with ovulation on day 14.**

3-Secretory Phase



- After **ovulation**, the **corpus luteum** begins to produce **progesterone**. This hormone causes
- the uterine lining to become rich in nutrients in preparation for pregnancy.
- **Estrogen** levels also remain **high** so that the lining is maintained. If pregnancy doesn't occur, the corpus luteum gradually degenerates, and the woman enters the ischemic phase of the menstrual cycle.

4-Ischemic Phase.

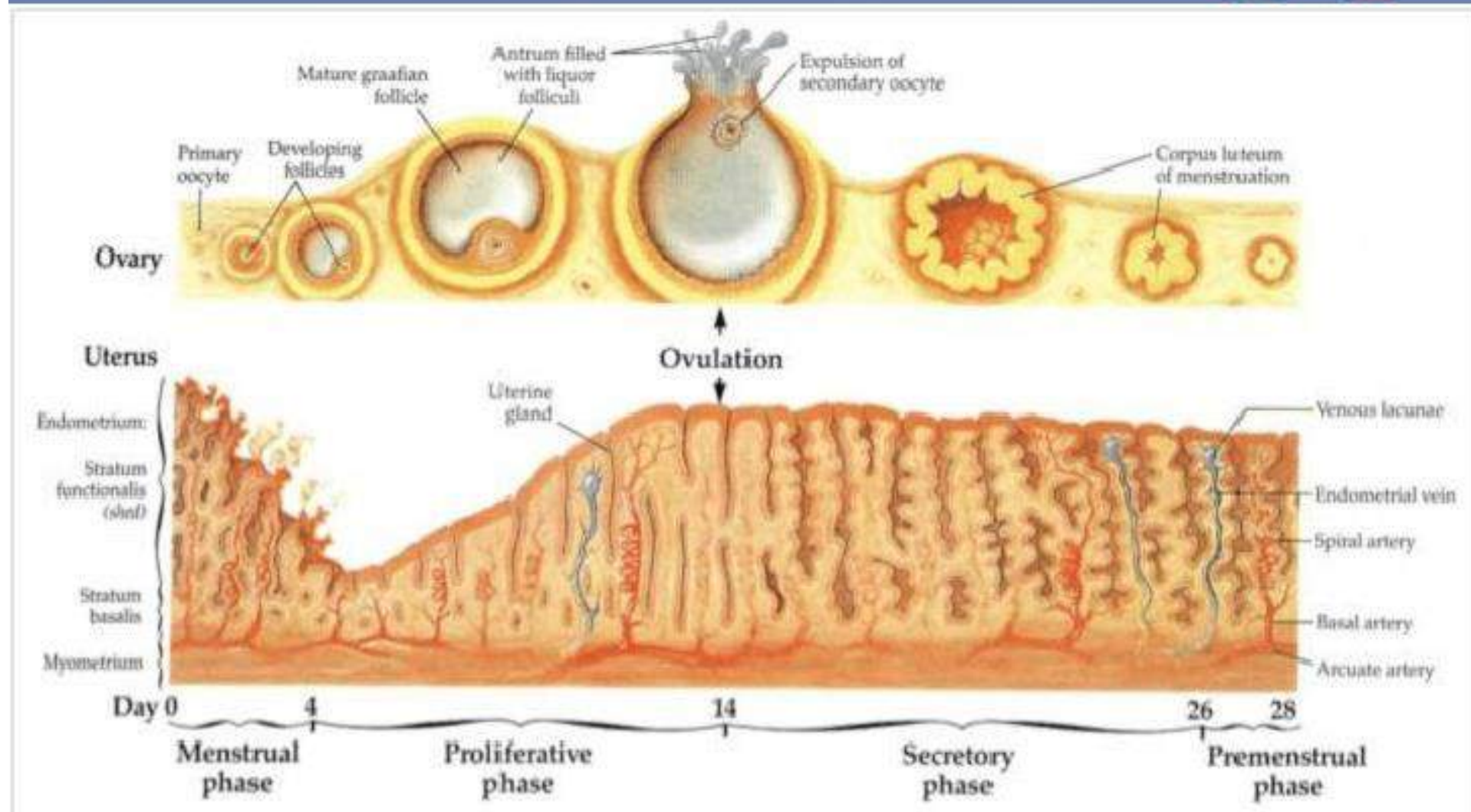
- On days 27 and 28, estrogen and progesterone levels fall because the corpus luteum is no longer producing them.
- Without these hormones to maintain the blood vessel network, the uterine lining becomes ischemic. When the lining start slough, the woman has come full cycle and is once again at day 1 of the menstrual cycle.

Menstrual Cycle



Endometrial Layer of the Uterus





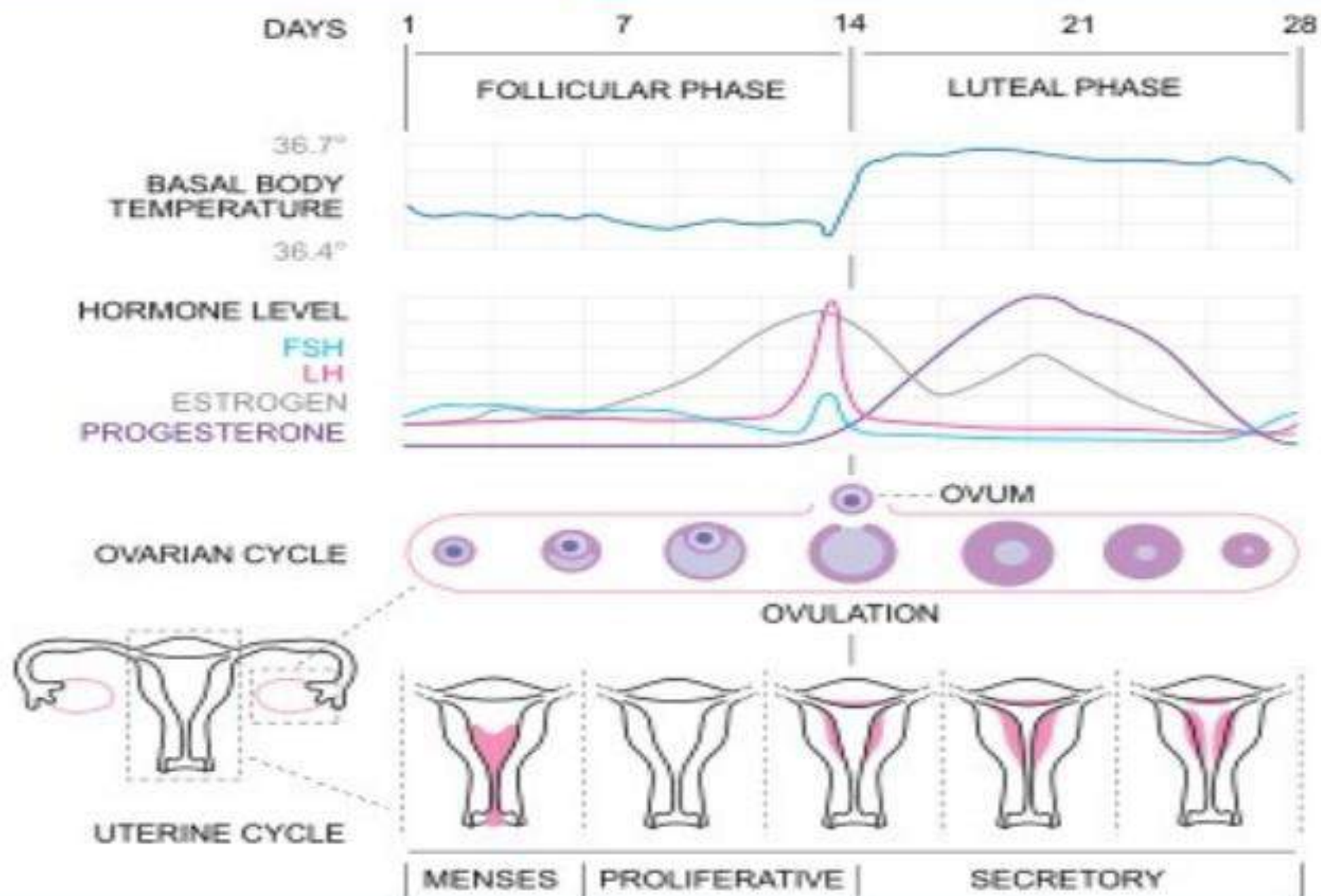
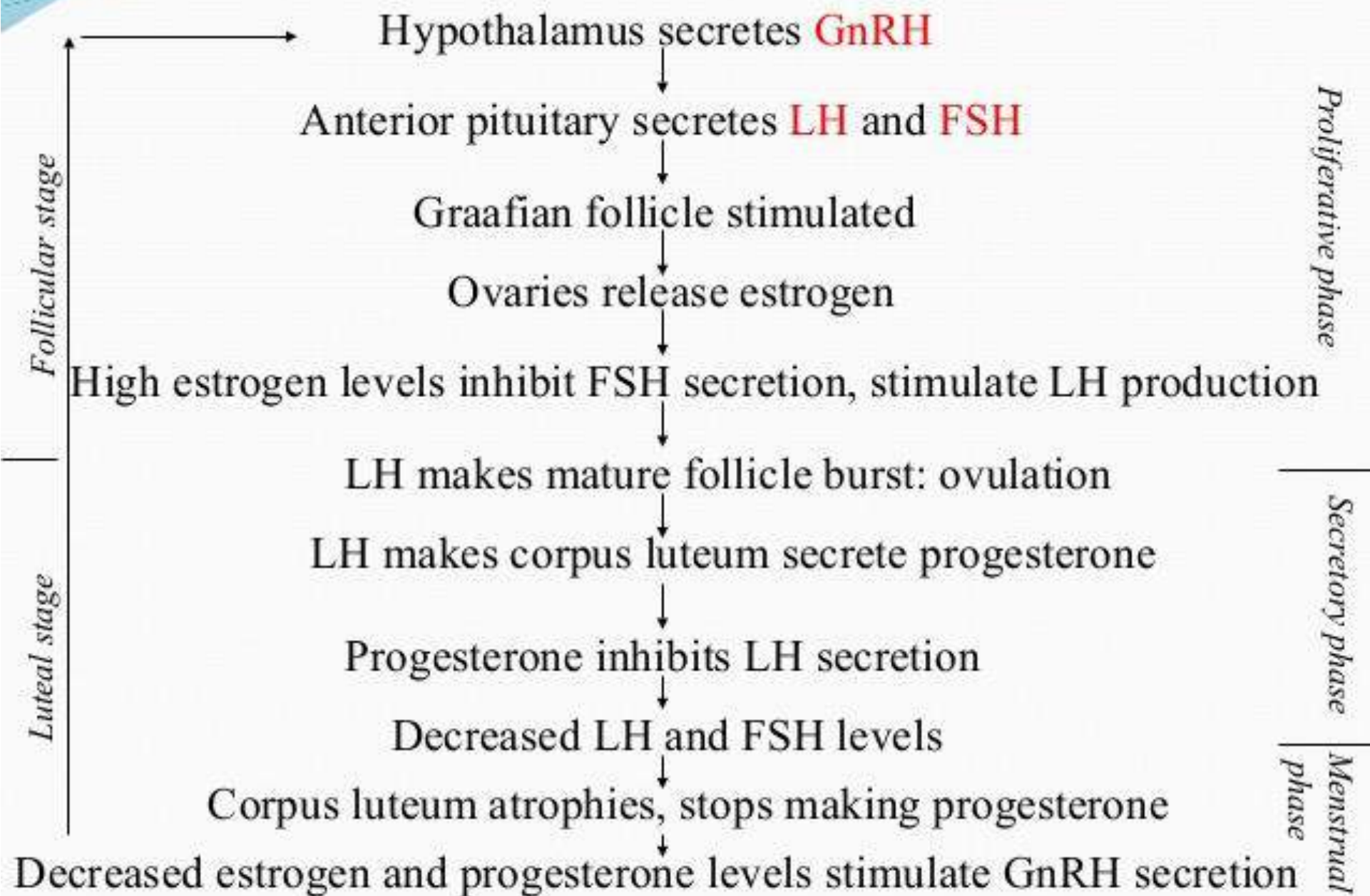


Fig. 34-1: Events of the Menstrual Cycle



CYCLE ABNORMALITIES

- **Anovulation**
- **Hypomenorrhea**
- **Metrorrhagia**
- **Oligomenorrhea**
- **Amenorrhea**
- **Polymenorrhea**

Term	Description
Amenorrhea	No periods
Dysmenorrhea	Painful periods
Hypomenorrhea	Regular menstruation occurring at normal intervals, but with minimal blood loss.
Menorrhagia, hypermenorrhea	or Regular menstruation occurring at normal intervals, but with heavy blood loss.
Menometrorrhagia	Prolonged bleeding that occurs at irregular intervals Menometrorrhagia (meno = prolonged, metro = short, rrhagia = excessive flow/discharge).
Metrorrhagia	Bleeding that occurs at frequent, irregular intervals (spotting)
Oligomenorrhea	Abnormal prolongation of the intermenstrual period, every five weeks or more.
Polymenorrhea	Regular menstruation, which is normal in amount but it, occurs at short intervals, three weeks or less.
Postmenopausal bleeding	Bleeding that occurs after menopause.
Premenstrual (PMS) syndrome	Physical and psychological symptoms that occur before the start of a period.
Primary amenorrhea	No periods ever starting (at puberty).
Secondary amenorrhea	Periods that has stopped.