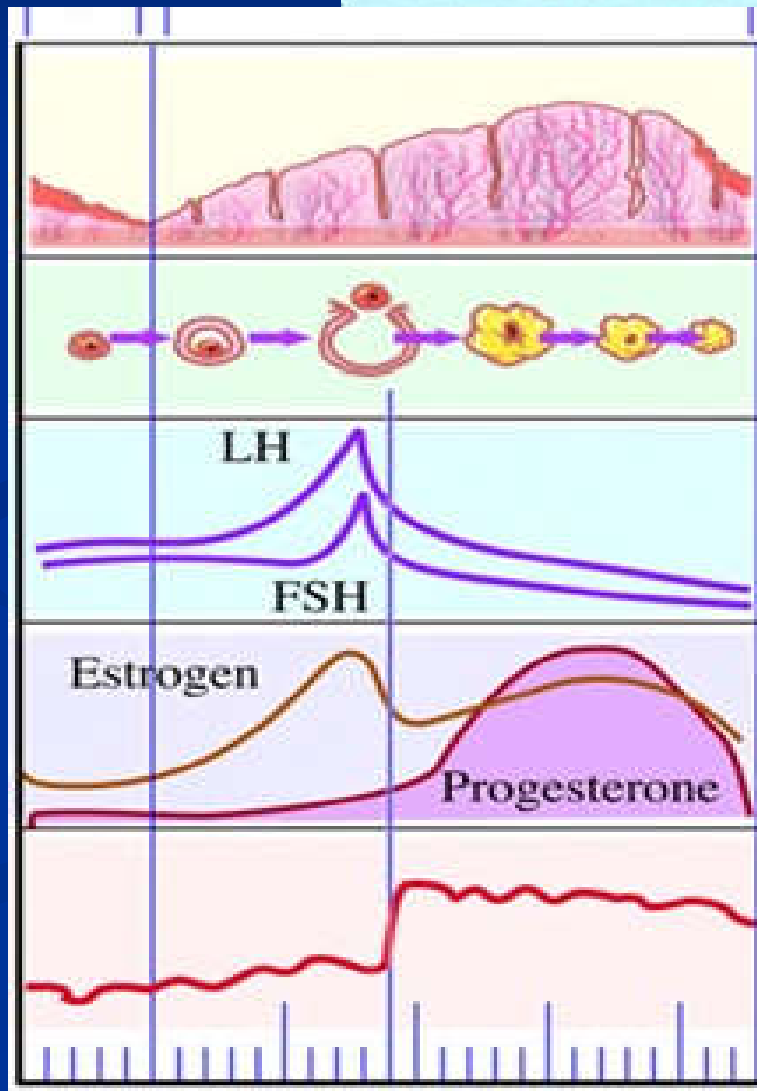
Physiology of Menstruation



Learning objectives:

By the end of this lecture the students should be able to:

- **Define menstruation.**
- **List the Characters of normal menstruation**
- **Enumerate Components of normal menstrual cycle.**
- **Describe each of these components.**

Menstruation:

- It is the cyclic, visible, predictable bleeding caused by endometrial shedding.
- It occurs in the childbearing period (between menarche & menopause).

Characters of normal menstruation:

- **Menarche :10-16 yrs.**
- **Duration of the period: 3-7 (5) days.**
- **Length of the cycle: 3-5 (4) weeks**
- **Amount : 30-80 ml.**
- **Menstrual blood: doesn't coagulate.**
- **May be preceded by menstrual molimina**

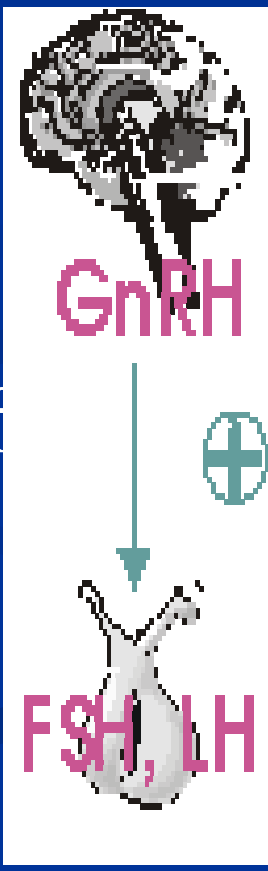
Components of normal menstruation:

- hypothalamo-hypophyseal axis.
- Ovarian Cycle.
- Endometrial cycle
- Cervical cycle
- Vaginal cycle
- Breast cycle.

The hypothalamo-hypophyseal axis:

- **The hypothalamus secrets:**

1. **GnRH in pulsatile manner (every 60-90 min).**



- **GnRH stimulates the production of FSH and LH from the anterior pituitary.**

Ovarian Cycle:

Follicular phase:

- **Recruitment:** starts 4-5 days before menstruation, as **cohort of follicles**; caused by the relative high level of FSH.
- **Selection & dominance:** the **leading follicle** is selected within the 1st 7 days of the cycle; with atresia of the others; due to gradually **increasing estrogen** level with gradually **decreasing FSH** with **different sensitivities** of the follicles to this low level of FSH with **low threshold in the dominant follicle** than the atretic ones.

Ovarian Cycle (cont.):

Follicular phase (cont):

- **Growth & development of the dominant Follicle: from the 7^{th} day till ovulation under the effect of FSH with production of rising estrogen.**

Ovarian Cycle (cont.):

Ovulatory phase: caused by estrogen-provoked LH surge which causes:

- **1st meiotic division.**

- **Follicular rupture & extrusion: caused by**

1. **Enzymatic: ↑ plasmin.**
2. **Prostaglandins.**
3. **↑ antral pressure.**
4. **Ovarian contractility**

- **Luteinization.**

Ovarian Cycle (cont.):

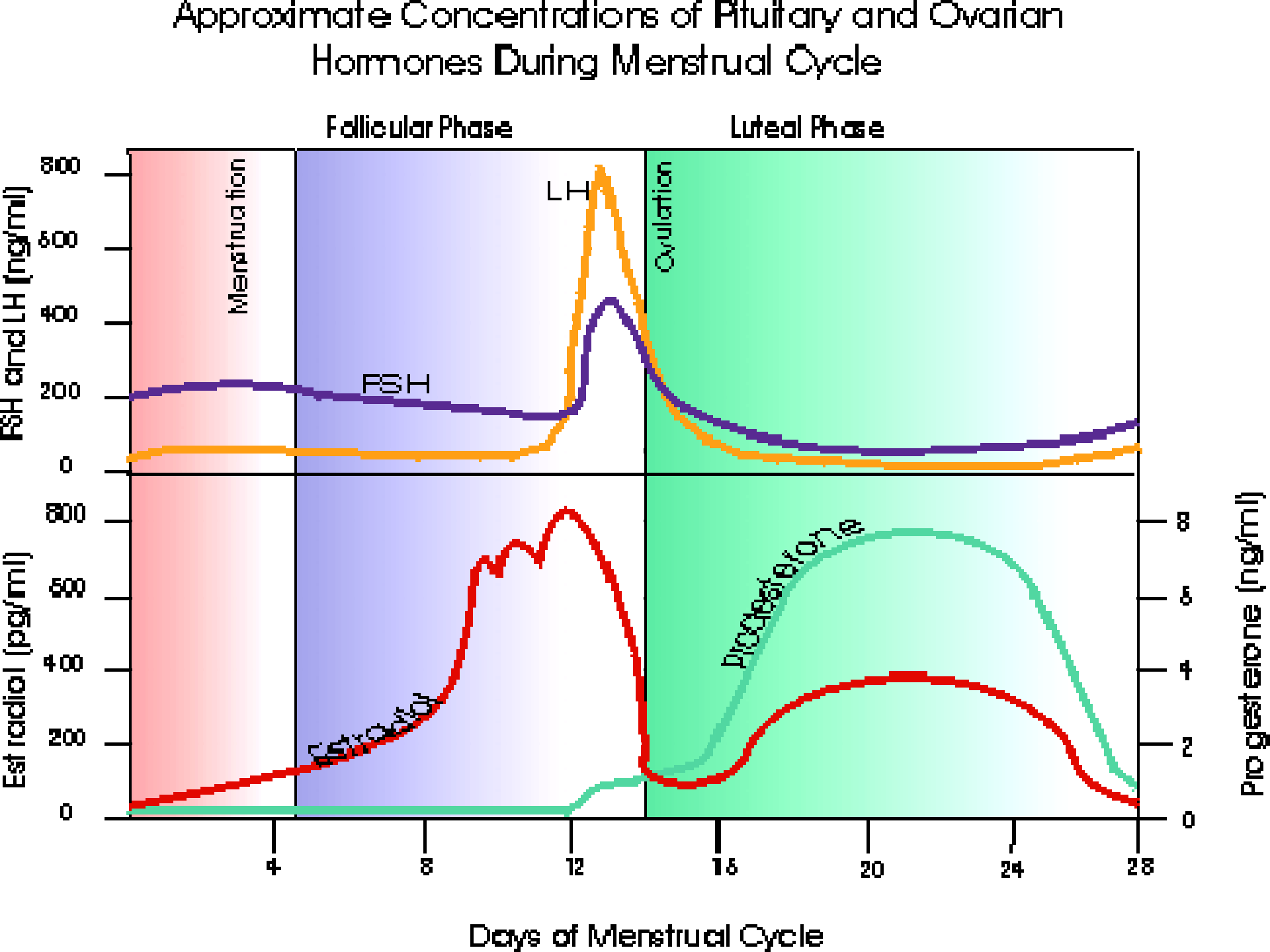
- **Luteal phase: from ovulation till either nidation or menstruation:**
  - **14±2 days.**
  - **Corpus luteum formation with production of estrogen and progesterone which produce:**

1. **↑ Basal body temp.**
2. **Secretory end.**
3. **Cervical mucus changes.**
4. **-ve feedback:→ ↓ FSH & LH**

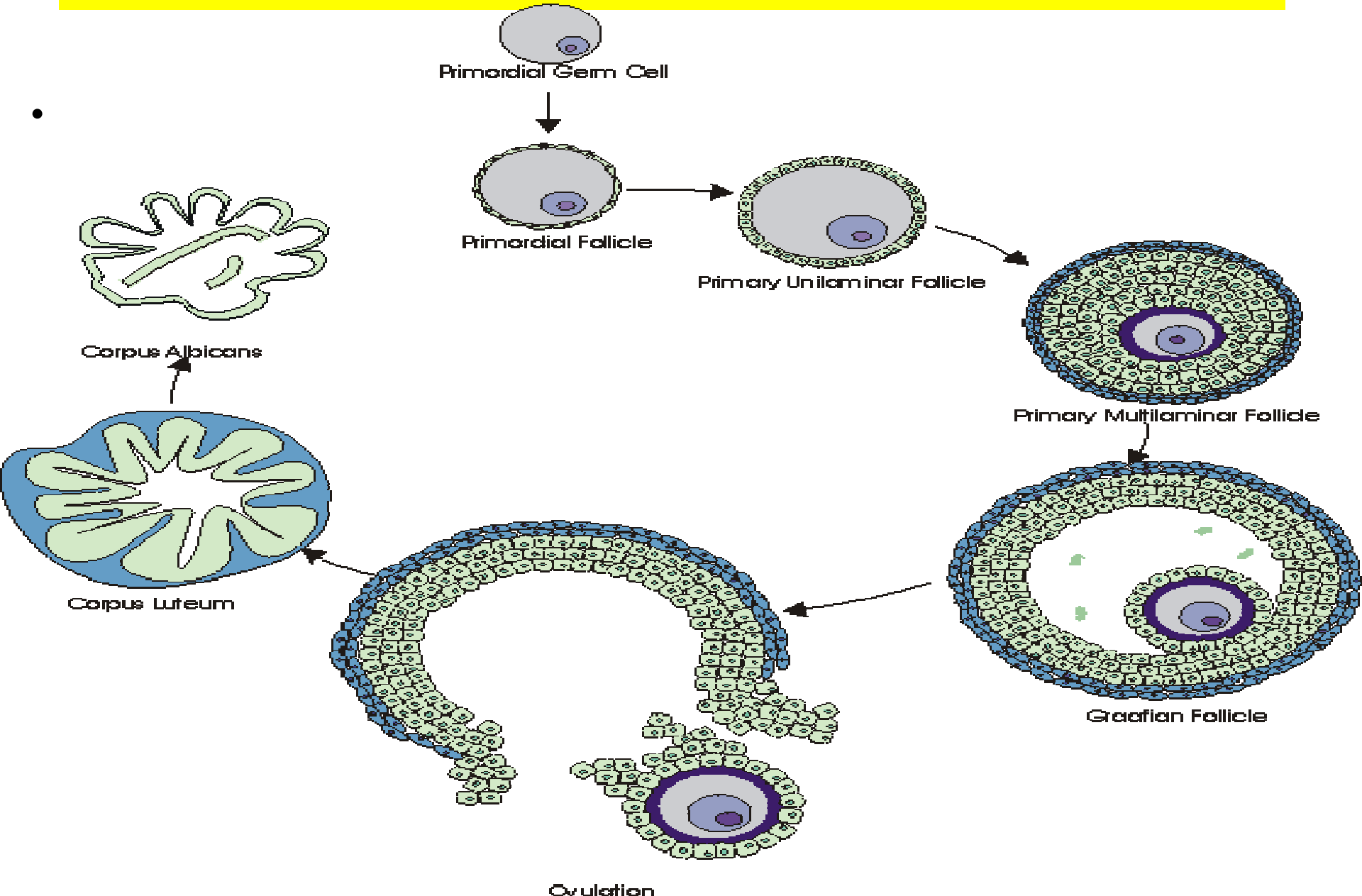
Ovarian Cycle (cont.):

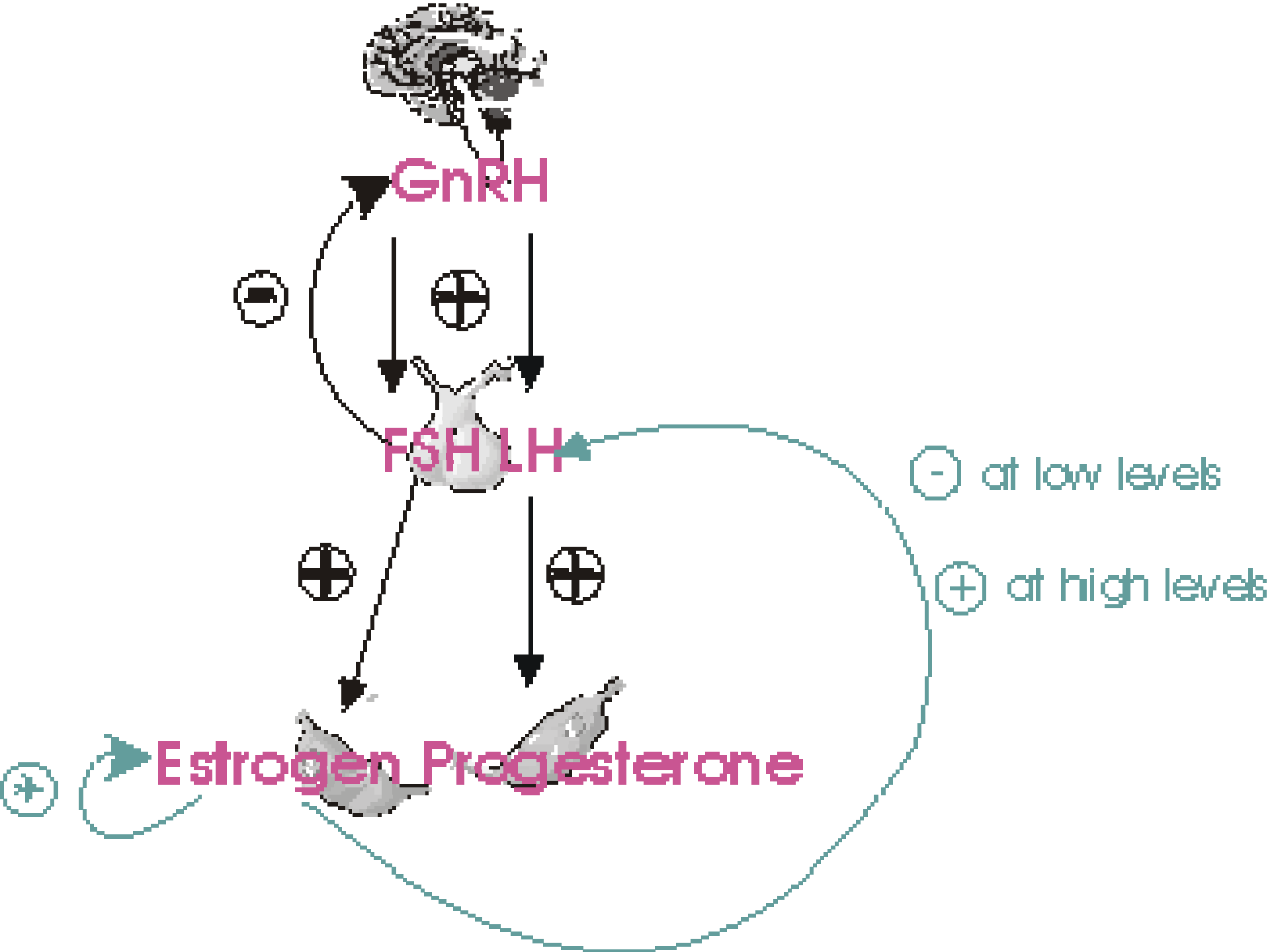
- **Luteal phase (cont):**
  - **Fate of CL:**

1. **Nidation : hCG appears by the 9th day post ovulatory & maintains CL**
2. **No nidation : the corpus luteum degenerates by the 10th day post ovulatory → corpus albicans with ↓ estrogen and progesterone levels →:**
   - **separation of the endometrium and menstruation.**
   - **Premenstrual ↑FSH → new follicular recruitment**


Approximate Concentrations of Pituitary and Ovarian Hormones During Menstrual Cycle
Follicular Phase
Luteal Phase
Menstruation
Ovulation
LH
FSH
Estradiol
Progesterone
FSH and LH (ng/ml)
Estradiol (pg/ml)
Progesterone (ng/ml)
800
600
400
200
0
8
6
4
2
0
4
8
12
16
20
24
28
Days of Menstrual Cycle

Ovarian Cycle:




GnRH
FSH LH
Estrogen Progesterone
- at low levels
+ at high levels

Endometrial cycle:

- **Menstrual phase:**
  - 3-7 (5) days, the time of bleeding.
- **Proliferative phase:**
  - 9-10 days.
  - Microscopically; Characterized by
    1. Endometrial thickness 3-4 mm
    2. Glands starting to ↑ in number and length.
    3. Stromal cell starting to ↑in size.
    4. Vascularity increases.

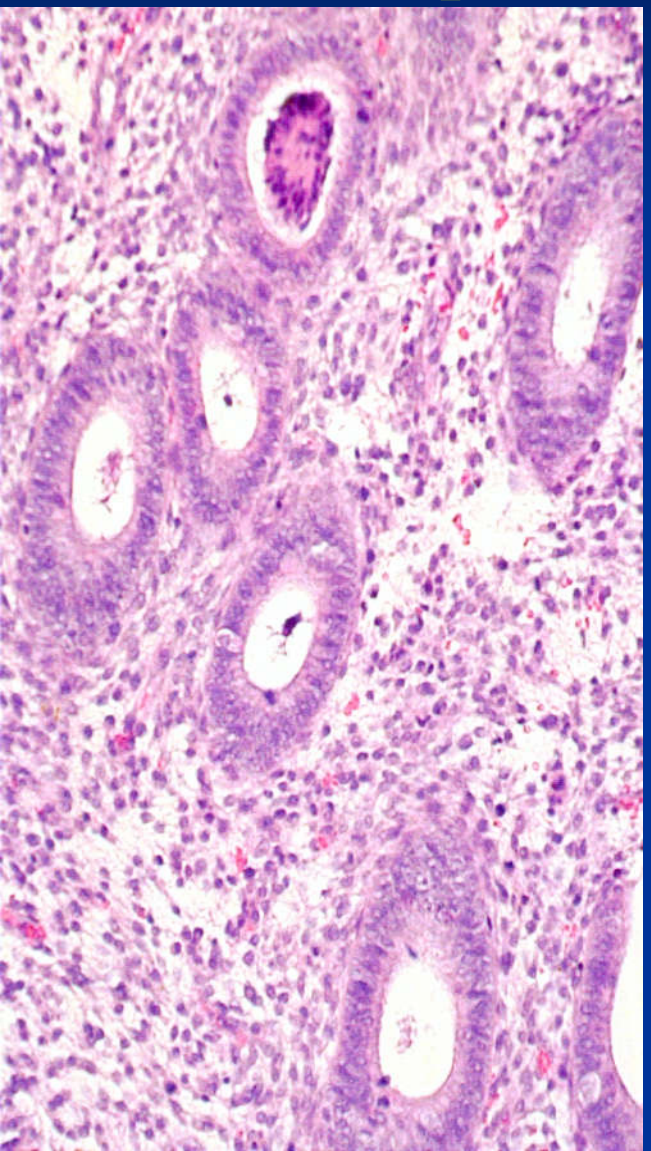
Endometrial cycle:

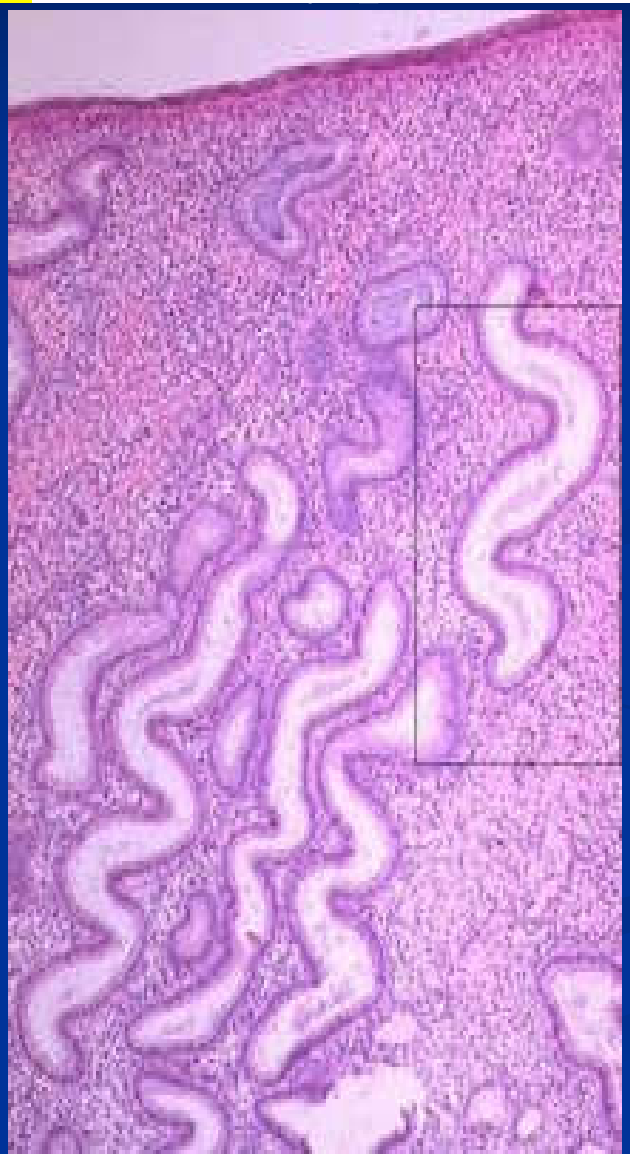
- **Secretory phase:**
  - 14±2 days.
  - **Microscopically;** Characterized by:

1. **Endometrial thickness:** 6-8 mm.
2. **Glands:** continue to grow, become tortuous
3. **Stromal cell:** ↑ in size, forming 3 layers: **superficial** compact layer, **middle** spongy layer and **deep** compact layer.
4. **Vascularity:** ↑ forming 2 types: **basal** arterioles , **spiral** arterioles.

Endometrial cycle:

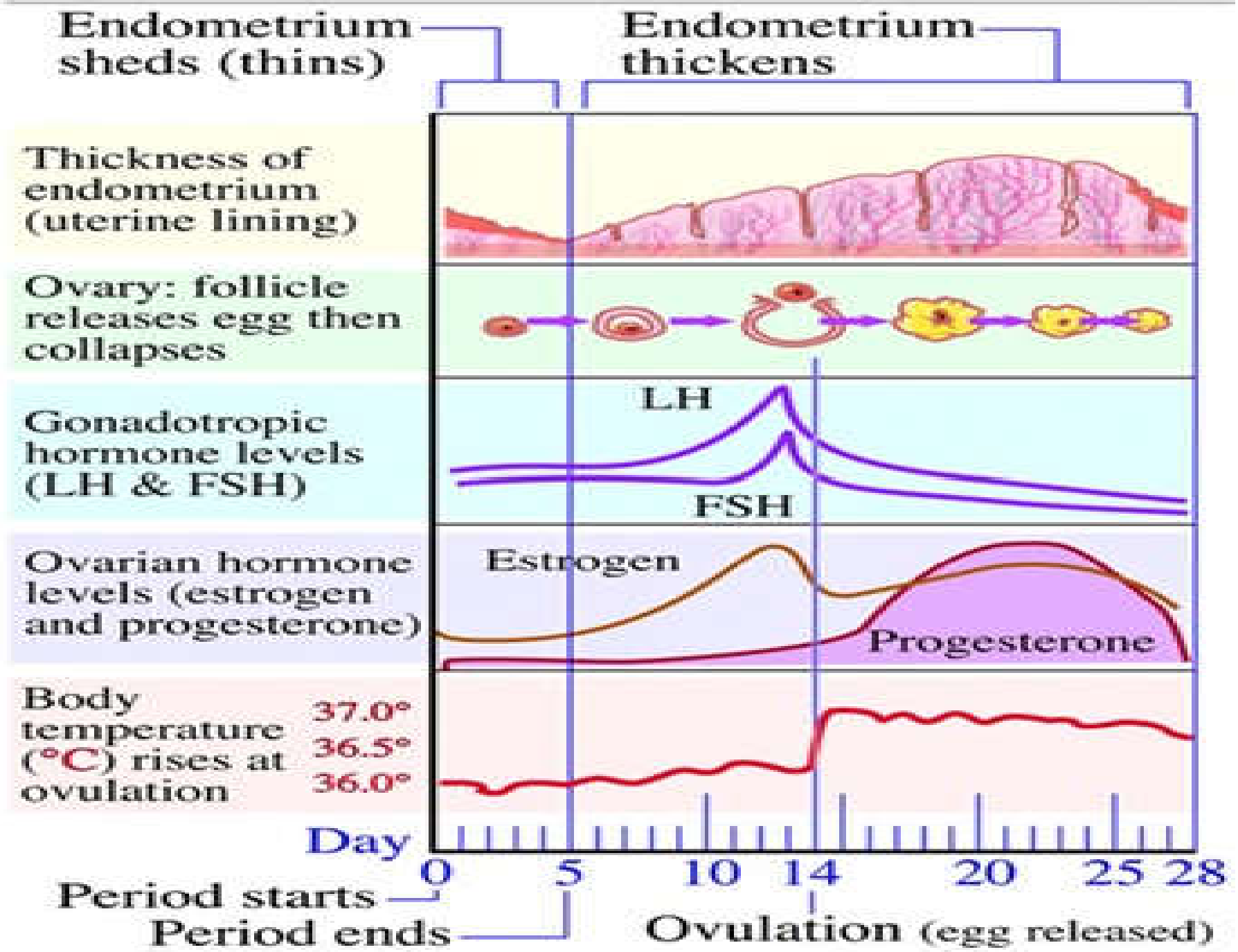
Proliferative phase **Secretory phase** **Menstrual phase**





Mechanism of menstruation :

- Corpus luteum degenerates leads to drop in estrogen and progesterone.
- Leads to edema and shrinkage of the endometrium, ↑ coiling of spiral arterioles , ischemia & necrosis of superficial and middle layers of endometrium.
- Necrotic area separate leading to bleeding.
- Basal layer not involved because it is supplied by basal arterioles.


Endometrium sheds (thins)
Endometrium thickens
Thickness of endometrium (uterine lining)
Ovary: follicle releases egg then collapses
Gonadotropic hormone levels (LH & FSH)
LH
FSH
Ovarian hormone levels (estrogen and progesterone)
Estrogen
Progesterone
Body temperature (°C) rises at ovulation
37.0°
36.5°
36.0°
Day
0
5
10
14
20
25
28
Period starts
Period ends
Ovulation (egg released)

Cervical Cycle:




Day 3	Day 6	Day 14	Day 22
- still menstruating .	- firm, - closed os - no cervical fluid	- soft, - opened os, - stretchy CF like egg white, probably about to ovulate	- firmer -closed os, -viscid mucus

Vaginal cycle

	1st half	2nd half
•Epithelium	cornified	proliferated
•Smears	Cornified cells	leukocytes infiltration
•Discharges	watery	thick mucus

Breast cycle

	Estrogen	Progesterone
Histologically	proliferation of mammary ducts	growth of lobules and alveoli
Clinically	Nearly free	breast swelling, tenderness and pain 10 days preceding menstruation