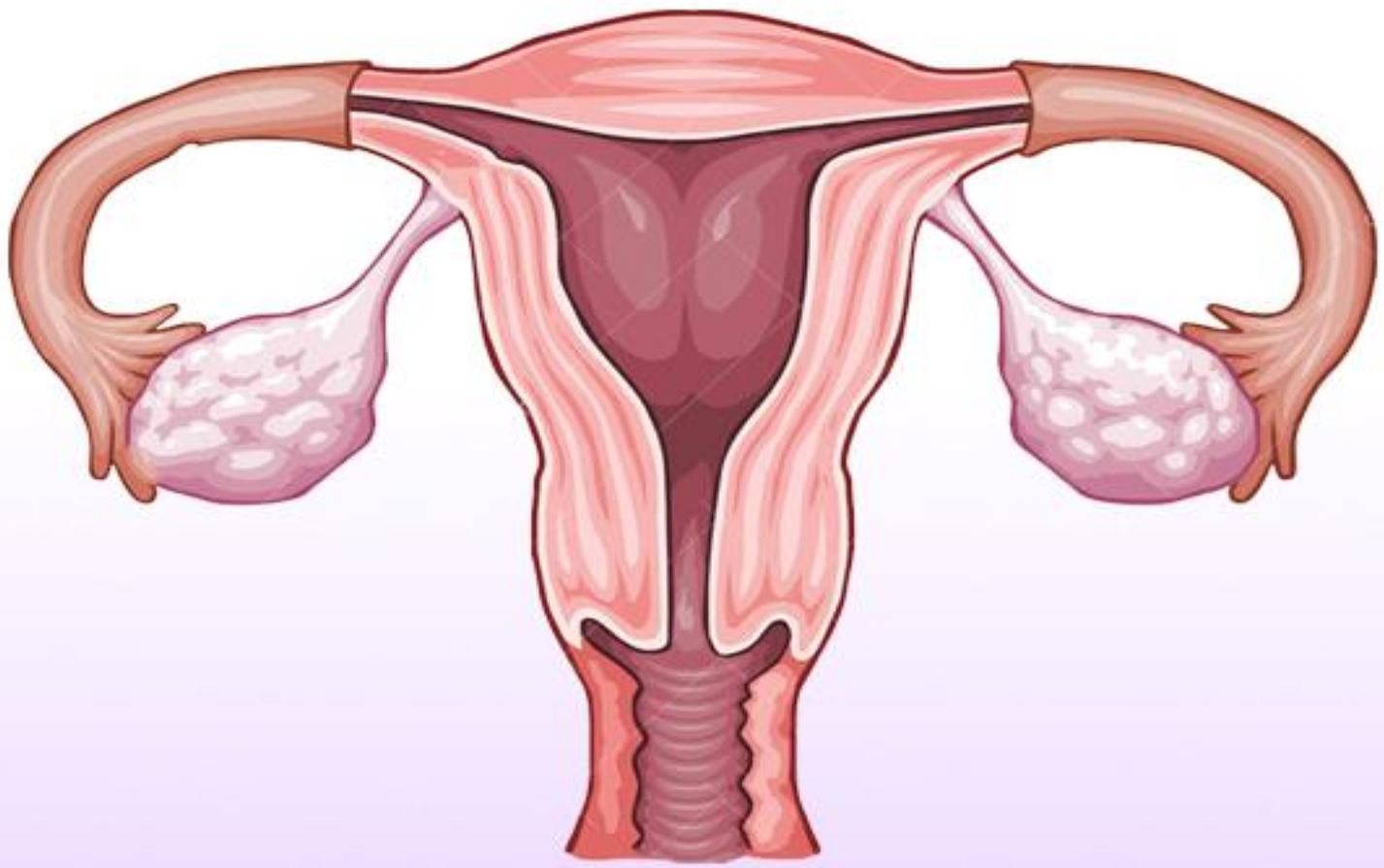
Physiology team



Lecture5:
Uterine cycle

Sources:

- ✓ **Male slides**
- ✓ **Gyton: P995, P996, P999**

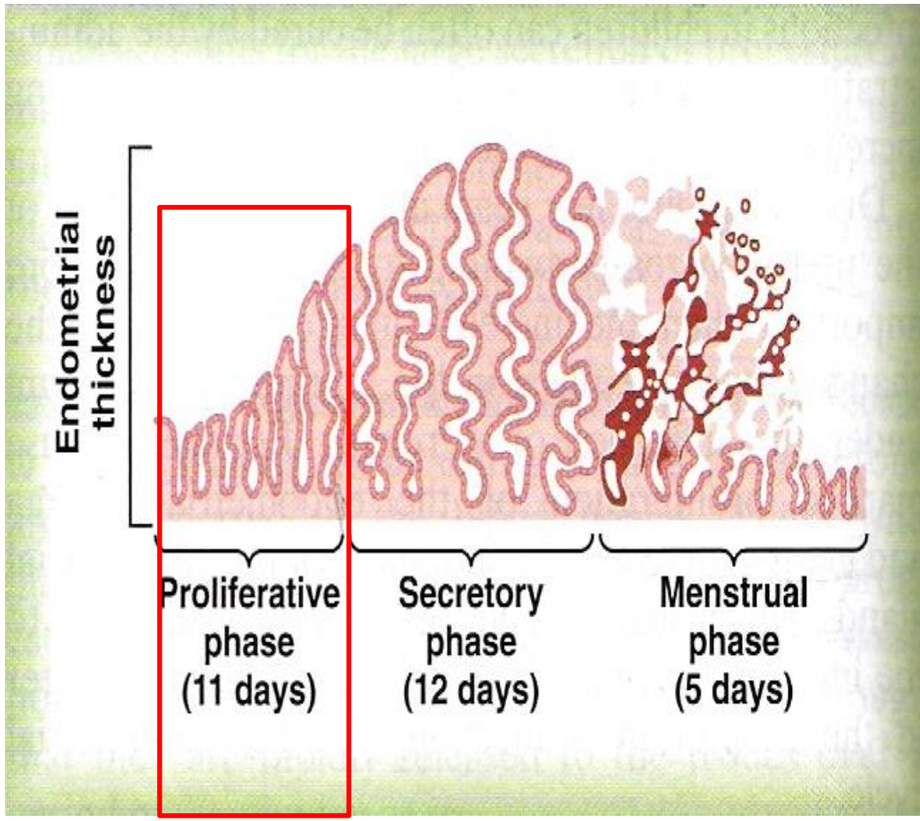
Objectives

1. Describe the normal menstrual cycle
2. Discuss the structural changes that occur in the endometrium during the menstrual cycle and explain how these changes are hormonally controlled
3. Recognize the phases of the menstrual cycle
4. Describe the physiology of menopause and the disorders of menstruation

- **At the beginning of each cycle,** most of the endometrium has been **desquamated by menstruation**. **After menstruation,** only thin layer of the endometrial stroma, the deeper portions of the glands & crypts is remain

Proliferative phase (Estrogen phase):

- It corresponds to the follicular phase of the ovarian cycle
- under the influence of **estrogens**, the stromal cells & epithelial cells proliferate rapidly.
- The endometrial surface re-epithelized within 4-7 days after the beginning of menstruation.
- At the time of ovulation, **the endometrium is 3-5 mm thick.**
- The endometrial glands, cervical region secrete a thin, stringy mucus **which helps to guide sperm in the proper direction from the vagina into the uterus.**

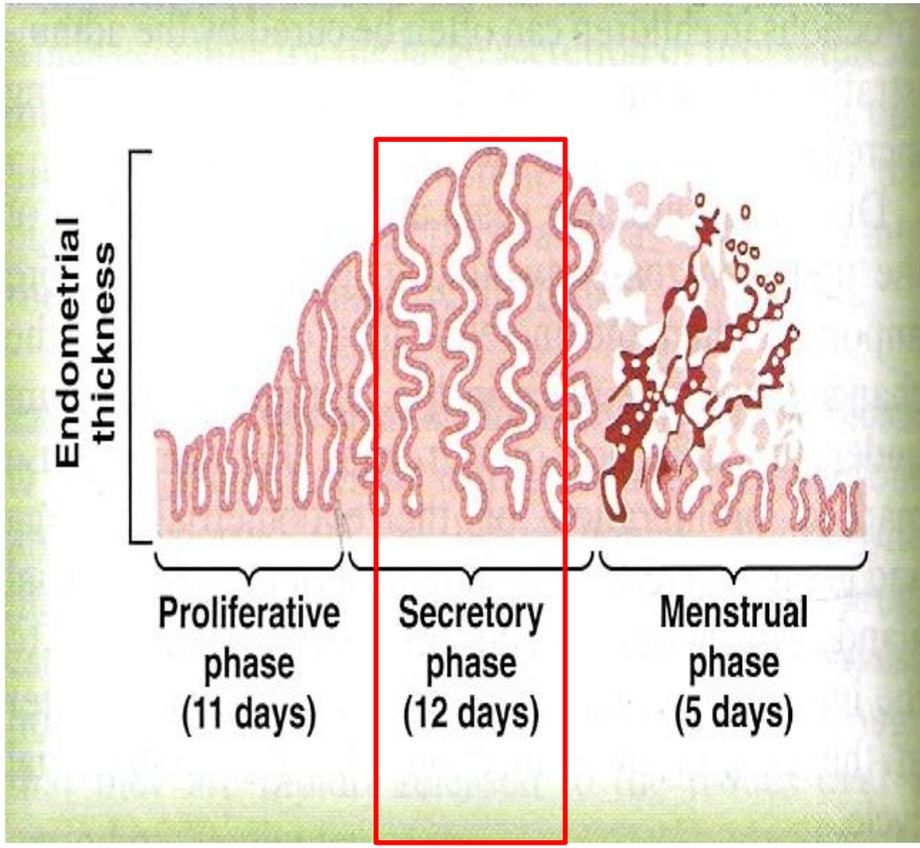


TO SUM UP:

Proliferative phase	
When?	Before ovulation (Preovulatory)
Major hormone	Estrogen
What happens?	1. During mensturation there's will be no functional layer (superficial layer), only basal layer (deeper layer) will remain (this point will be before proliferative phase) 2. When proliferative phase begins, estrogen will re-epithelized the endometrial surface, and thickens it to be 3-5 mm at time of ovulation 3. The endometrial glands in cervical region secretes a mucus that guides the sperm from vagina to uterus

Secretory phase (progestational phase)

- It corresponds to the luteal phase of the ovarian cycle
- **After ovulation, progesterone** causes marked swelling & secretory development of the endometrium
- **Estrogen** cause slight additional cellular proliferation
- Stromal cells cytoplasm increase, lipid &glycogen deposits in the cells, blood supply to the endometrium increases and become more tortuous. **1 week after ovulation, endometrium thickness is 5-6 mm.**
- The whole purpose of all these endometrial changes is to produce a highly secretory endometrium that contains large amounts of stored nutrients to provide appropriate conditions for implantation of a fertilized ovum
- Uterine secretions called "uterine milk" provide nutrition for the dividing ovum



TO SUM UP:

Secretory phase	
When?	After ovulation (Postovulatory)
Major hormone	Progesterone
What happens?	1. Preparing the endometrium to receive a fertilized ovum by: • Increase secretory activity in the endometrium • Increase the vascularity in the endometrium 2. Uterine secretions called "uterine milk" provide nutrition for the dividing ovum

Menstruation

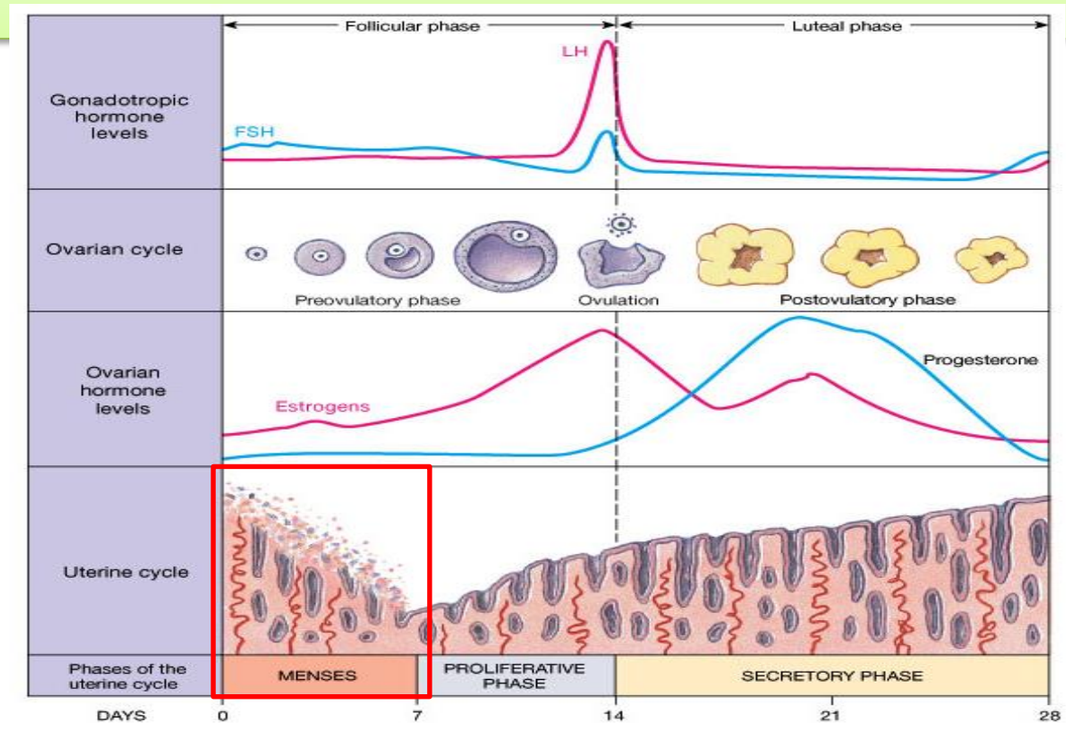
- If the ovum is not fertilized, **about 2 days before the end of the monthly cycle**, the corpus luteum in the ovary suddenly involutes and the ovarian hormones (estrogens and progesterone) decrease to low levels of secretion

(so menstruation is caused by the reduction of estrogens "minor" and progesterone "mainly")

- Necrosis is initiated in the endometrial blood vessels, due to:
    1. Vasospasm
    2. Decrease nutrients to the endometrium
    3. Loss of the hormonal stimulation
- The mass of desquamated tissue & blood plus the **contractile effects of prostaglandins** all initiate contractions which expel the uterine contents
- **In normal menstruation**, about 40 ml of blood and an additional 35 ml of serous fluid are lost.
- The menstrual blood is normally non-clotting due to the presence of **fibrinolysin**

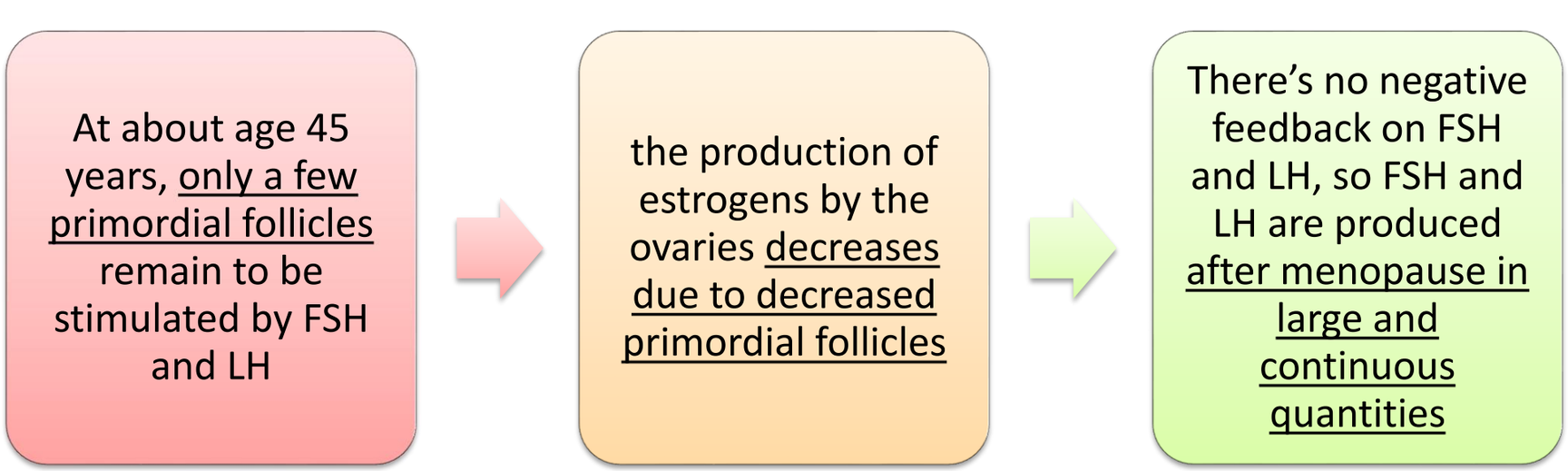
Leukorrhea during menstruation

During menstruation, leukocytes are released with the necrotic material & blood so the uterus is highly resistant to infection during menstruation as protective mechanism



Menopause

- At the age of 40 to 50 years, the sexual cycle becomes irregular, ovulation fails to occur & the cycle ceases
- The loss of estrogens causes marked physiological changes in the function of the body including:
  - ✓ “hot flushes” characterized by extreme flushing of the skin;
  - ✓ psychic sensations and dyspnea;
  - ✓ Irritability
  - ✓ fatigue
  - ✓ anxiety
  - ✓ occasionally various psychotic states
  - ✓ decreased strength and calcification of bones throughout the body.



Dr. AlOtaibi said there will be a question about (Menopause), and most likely will be:
Q: What do you expect to see in a blood of 40-50 years female?
A: High FSH and LH, due to the absence of the –ve feedback effect

Abnormalities of secretion by the ovaries

Hypogonadism

- Reduced Secretion by the Ovaries, Can result from:

✓ **poorly formed ovaries, lack of ovaries, or genetically abnormal ovaries** that secrete the wrong hormones because of missing enzymes in the secretory cells.

- When ovaries are absent from birth or when they become nonfunctional before puberty, **female eunuchism** occurs.

✓ **Female eunuchism:** Tall women, Lack of secondary sexual characteristics and infantile

Hypersecretion by the Ovaries: Due to tumors such as **Granulosa cell tumor**

Disorders of Menstruation

Amenorrhea:

- Is absence of menstrual period either
- Primary amenorrhea: in which menstrual bleeding has never occurred.
- Secondary amenorrhea: cessation of cycles in a woman with previously normal periods, causes:
  - ✓ Pregnancy **(is the most common cause)**
  - ✓ Emotional stimuli and changes in the environment.
  - ✓ Hypothalamic diseases (↓ GnRH pulses)
  - ✓ Pituitary disorders
  - ✓ Primary ovarian disorders and various systemic disease.

Menorrhagia:

- Refer to abnormally heavy or prolonged bleeding.

Hypomenorrhea:

- Refer to scanty flow.

Dysmenorrhea:

- Painful menstruation:
  - ✓ cramps due to accumulation of prostaglandins in the uterus
  - ✓ Treatment: inhibitors of prostaglandin synthesis

Summary

Menstrual cycle (Figure 7-19)

1. Follicular phase (days 0–14)

- A **primordial follicle develops** to the graafian stage, with atresia of neighboring follicles.
- LH and FSH receptors are up-regulated in theca and granulosa cells.
- **Estradiol levels increase** and cause **proliferation of the uterus**.
- **FSH and LH levels are suppressed** by the negative feedback effect of estradiol on the anterior pituitary.
- Progesterone levels are low.

2. Ovulation (day 14)

- occurs 14 days before menses, regardless of cycle length. Thus, in a 28-day cycle, ovulation occurs on day 14; in a 35-day cycle, ovulation occurs on day 22.
- A burst of estradiol synthesis at the end of the follicular phase has a **positive feedback** effect on the secretion of FSH and LH **(LH surge)**.
- **Ovulation** occurs as a result of the **estrogen-induced LH surge**.
- Estrogen levels decrease just after ovulation (but rise again during the luteal phase).
- **Cervical mucus increases** in quantity; it becomes less viscous and more penetrable by sperm.

3. Luteal phase (days 14–28)

- The **corpus luteum** begins to develop, and it **synthesizes estrogen and progesterone**.
- **Vascularity and secretory activity of the endometrium increase** to prepare for receipt of a fertilized egg.
- **Basal body temperature increases** because of the effect of progesterone on the hypothalamic thermoregulatory center.
- If fertilization does not occur, the **corpus luteum regresses** at the end of the luteal phase. As a result, estradiol and progesterone levels decrease abruptly.

4. Menses (days 0–4)

- The **endometrium is sloughed** because of the abrupt withdrawal of estradiol and progesterone.

MCQs

1. During menstruation, which layer will remain:

A. Basal layer
B. Functional layer
C. Both

2. Uterine milk occurs during which phase?

A. Proliferative phase
B. Secretory phase
C. Menstruation

3. What is Menorrhagia?

A. Refer to abnormally heavy or prolonged bleeding
B. Refer to scanty flow
C. Is absence of menstrual period

4. Why there's high FSH and LH in menopause?

A. Due to increased estrogens
B. Due to increased primordial follicles
C. Due the absence of –ve feedback effect

5. Menstruation is caused by:

A. Reduction of prostaglandins
B. Reduction of estrogens and progesterone
C. Increased estrogens

6. Guiding sperm from vagina to uterus occurs in:

A. Proliferative phase
B. Secretory phase
C. Menstruation

1-A 2-B 3-A 4-C 5-B 6-A

@PhysiologyTeam

Pht433@gmail.com

Revised by:
Rahma Alshehri
Mojahed Otayf

Reproductive Block