PHYSIOLOGY OF UTERINE (ENDOMETRIAL) CYCLE

GUYTON & HALL, CHAPTER 81

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OBJECTIVES

By the end of this lecture, you should be able to:

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

EFFECTS OF ESTROGEN

A primary function of the estrogens is to cause cellular proliferation and growth of the tissues of the sex organs and other tissues related to reproduction.

- Growth of female rep organs: The ovaries, fallopian tubes, uterus, and vagina all increase several times in size.
- Estrogens cause marked proliferation of the endometrial stroma and glands, (nutrition to ovum). Similarly in fallopian tubes and increase the number of ciliated epithelial cells.
- Effect of Estrogens on the Breasts. (1) development of the stromal (2) growth of ductile system, and (3) deposition of fat in the breasts. The lobules and alveoli of the breast develop slightly under estrogens alone, but progesterone and prolactin that cause the ultimate growth and function
- Effect of Estrogens on the Skeleton; inhibit osteoclastic activity in the bones and therefore stimulate bone growth. However, they cause uniting of the epiphyses with the shafts of the long bones. female usually ceases earlier than growth of the male.

(Osteoporosis of the Bones Caused by Estrogen Deficiency in Old Age)

ESTROGEN EFFECTS

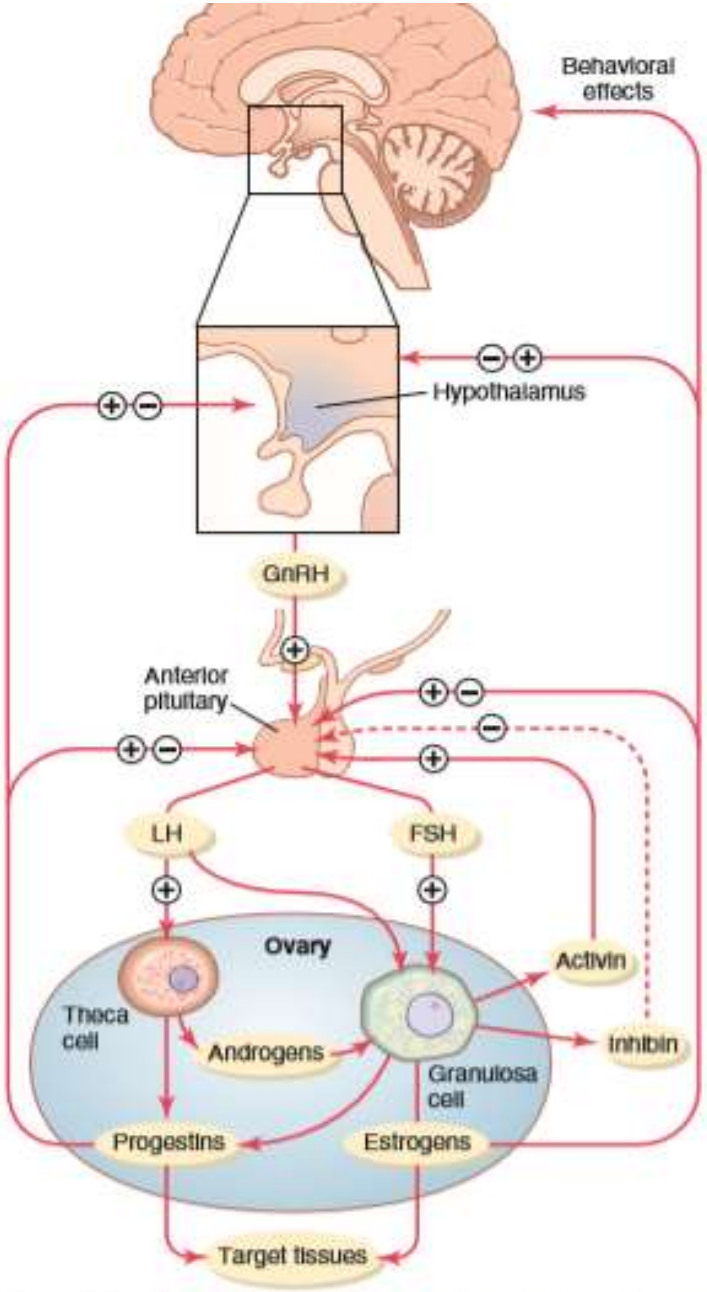
- Estrogens Slightly Increase Protein Deposition. Mainly due to growth of the sexual organs, the bones. Testosterone is much more general and much more powerful than estrogen.
- Estrogens Increase Body Metabolism (slightly) (only about 1/3 as much as by testosterone) and increase fat deposition .
- Estrogens Have Little Effect on Hair Distribution. Estrogens do not greatly affect hair distribution. adrenal androgens have greater effect on female hair
- Effect of Estrogens on the Skin. Development of a texture that is soft and usually smooth, but still thicker than in childhood
- Estrogens also cause the skin to become more vascular, which is often associated with increased warmth of the skin and also promotes greater bleeding of cut surfaces than is observed in men.
- Effect of Estrogens on Electrolyte Balance. Estrogens, like aldosterone and some other adrenocortical hormones, cause sodium and water retention by the kidney tubules. Significant during pregnancy due to estrogens by the placenta.

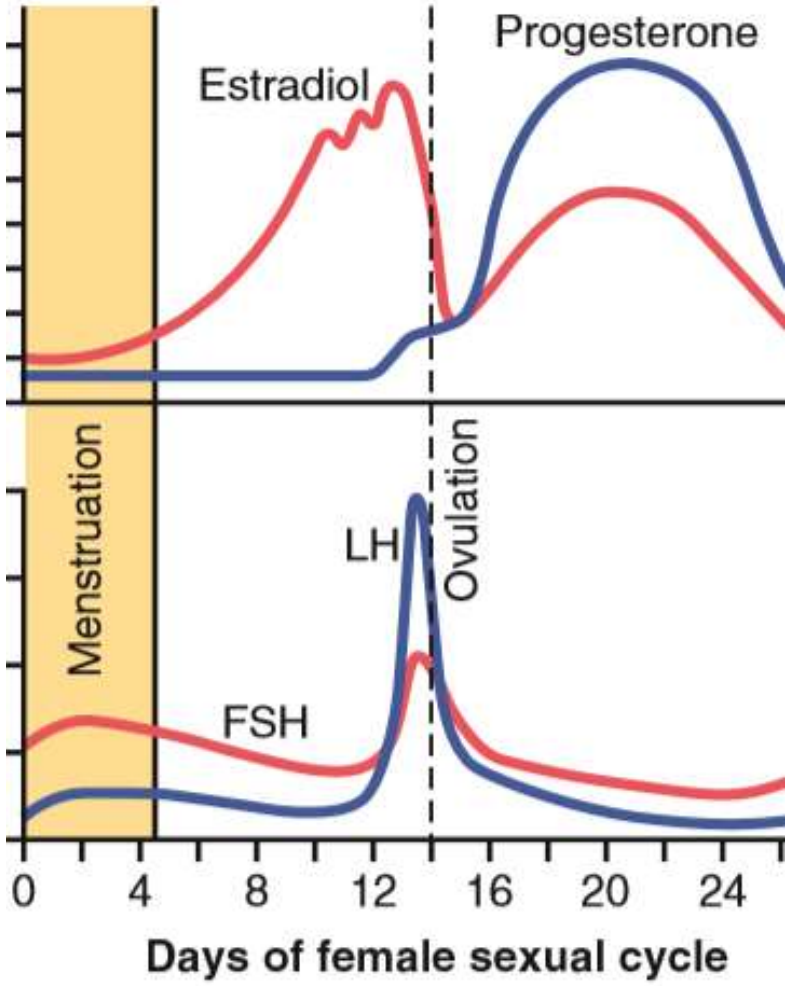
EFFECTS OF PROGESTERONE

- Progesterone Promotes Secretory Changes in the Uterus during the latter half of female cycle, thus preparing the uterus for implantation of the fertilized ovum, progesterone decreases the frequency and intensity of uterine contractions, thereby helping to prevent expulsion of the implanted ovum.
- Effect of Progesterone on the Fallopian Tubes. promotes increased secretion by the mucosal lining of the fallopian tubes. These secretions are necessary for nutrition of the fertilized, dividing ovum
- Progesterone Promotes Development of the Breasts. Progesterone promotes development and proliferation of the lobules and alveoli of the breasts, causing the alveolar cells to become secretory. Progesterone also causes the breasts to swell(secretory and fluids).

MONTHLY ENDOMETRIAL CYCLE AND MENSTRUATION

- It is associated with the monthly cyclical production of estrogens & progesterone by the ovaries in <u>the lining of the uterus</u>





. Approximate plasma concentrations of t
arian hormones during the normal femal
stimulating hormone; LH, luteinizing horr

Uterine (endometrial) Cycle

Proliferative phase **(estrogen Phase)** (Preovulatory)

Ovulation

Secretory phase **(progestational phase)** (Postovulatory)

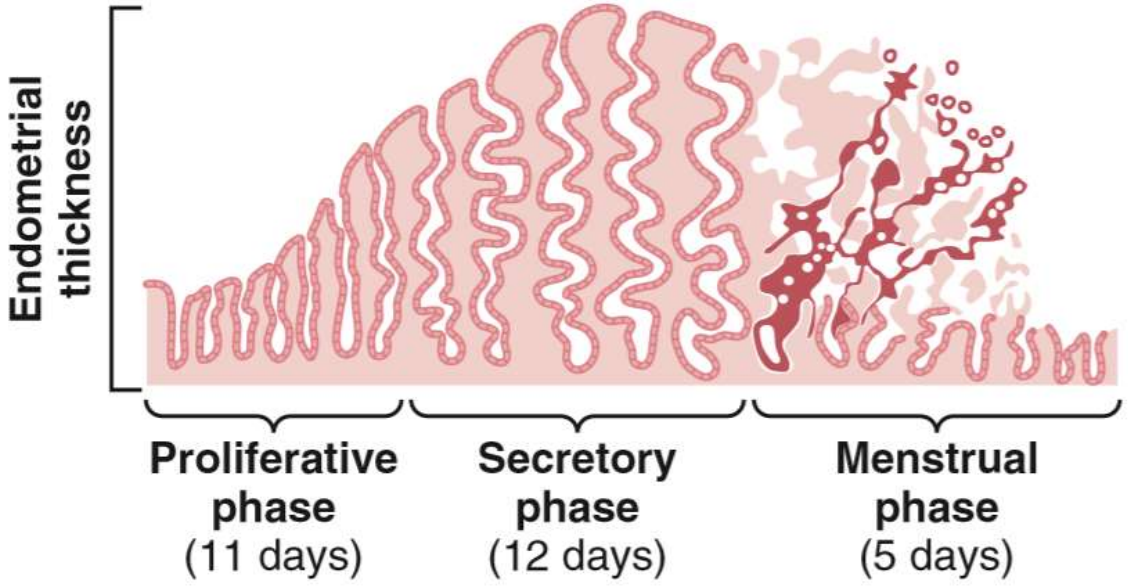
PROLIFERATIVE PHASE (ESTROGEN PHASE)

- At the beginning of each cycle, most of the endometrium has been desquamated by menstruation. After menstruation only thin layer of the endometrial stroma remains & the deeper portions of the glands &crypts of the endometrium.
- under the influence of **estrogens**, the stromal cells & epithelial cells proliferate rapidly.

- The endometrial surface re-epitheliaze within 4-7 days after the beginning of menstruation. Before ovulation the endometrium thickness increase, due to increase numbers of stromal cells &progressive growth of the glands & new blood vessels.

Uterine (endometrial) Cycle

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.



gure 82-9. Phases of endometrial growth and menstruation
uring each monthly female sexual cycle

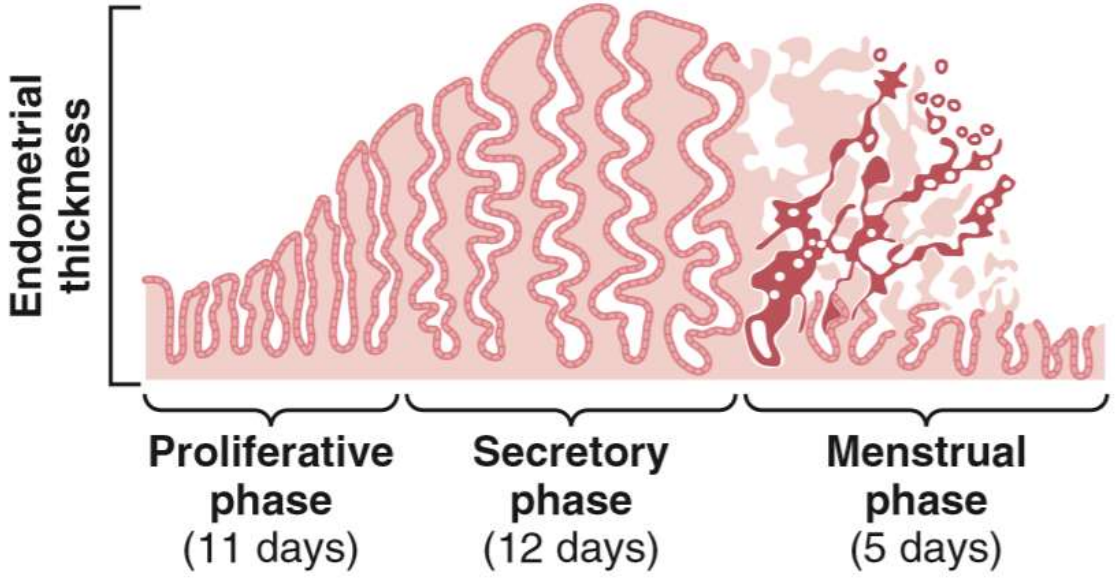
Secretory phase (progestational phase)

After ovulation, progesterone & estrogen are secreted in the later part of the monthly cycle by the corpus luteum. Estrogen causes slight proliferation in the endometrium& **progesterone** causes marked swelling & secretory development of the endometrium. The glands increase in tortuosity, excess secretory substances accumulate in the glands.

- 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.

Uterine (endometrial) Cycle

- The secretory changes prepare the endometrium (stored nutrients) for implantation of the fertilized ovum .Uterine secretions called "uterine milk" provide nutrition for the dividing ovum. The trophoblastic cells on the surface of the implanted ovum begin to digest the endometrium & absorb endometrial stored substances.



Menstruation

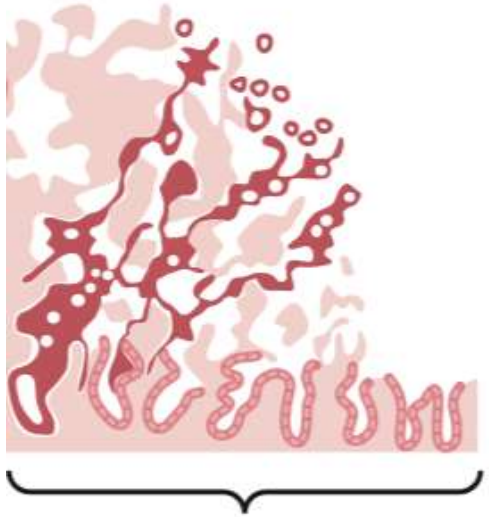
- Necrosis is initiated in the endometrial blood vessels, due to:

1) vasospasm

2) decrease nutrients to the endometrium

3) loss of the hormonal stimulation

- -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,



Menstrual phase
(5 days)

- The mass of desquamated tissue & blood plus the contractile effects of prostaglandins all initiate contractions which expel the uterine contents.

Menstruation

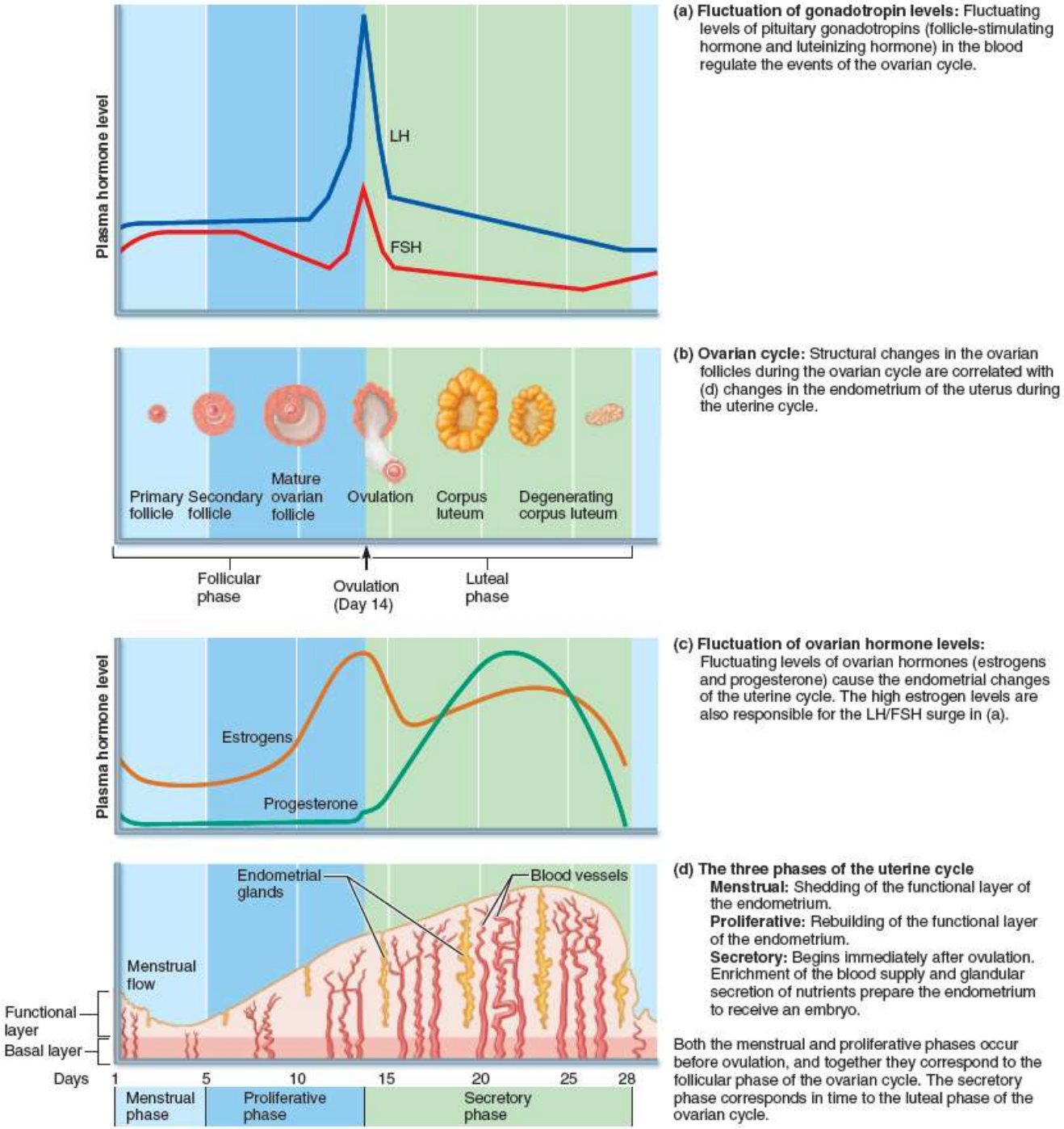
- **In normal menstruation**, about 40 ml of blood + 35 ml of serous fluid are lost. The menstrual blood is normally non-clotting due to the presence of fibrinolysin.

-Within 4 to 7 days after menstruation, the loss of blood ceases & the endometrium become re-epithelialized.

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.

Summary



(a) Fluctuation of gonadotropin levels: Fluctuating levels of pituitary gonadotropins (follicle-stimulating hormone and luteinizing hormone) in the blood regulate the events of the ovarian cycle.

(b) Ovarian cycle: Structural changes in the ovarian follicles during the ovarian cycle are correlated with (d) changes in the endometrium of the uterus during the uterine cycle.

(c) Fluctuation of ovarian hormone levels: Fluctuating levels of ovarian hormones (estrogens and progesterone) cause the endometrial changes of the uterine cycle. The high estrogen levels are also responsible for the LH/FSH surge in (a).

(d) The three phases of the uterine cycle
Menstrual: Shedding of the functional layer of the endometrium.
Proliferative: Rebuilding of the functional layer of the endometrium.
Secretory: Begins immediately after ovulation. Enrichment of the blood supply and glandular secretion of nutrients prepare the endometrium to receive an embryo.

Both the menstrual and proliferative phases occur before ovulation, and together they correspond to the follicular phase of the ovarian cycle. The secretory phase corresponds in time to the luteal phase of the ovarian cycle.

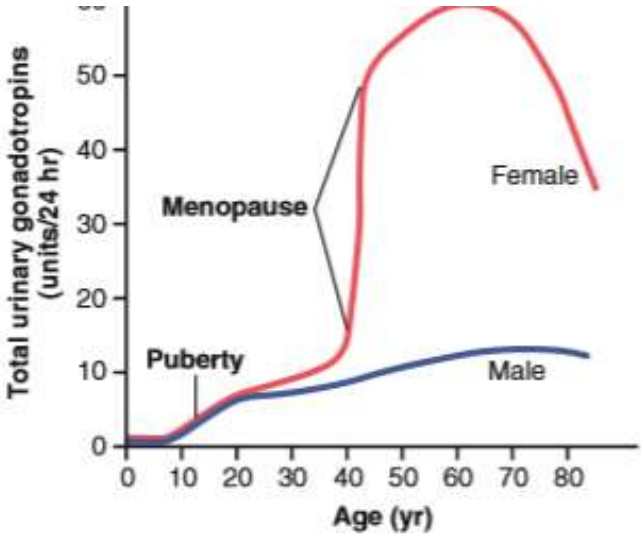
MENOPAUSE AND THE DISORDERS OF MENSTRUATION

Menopause

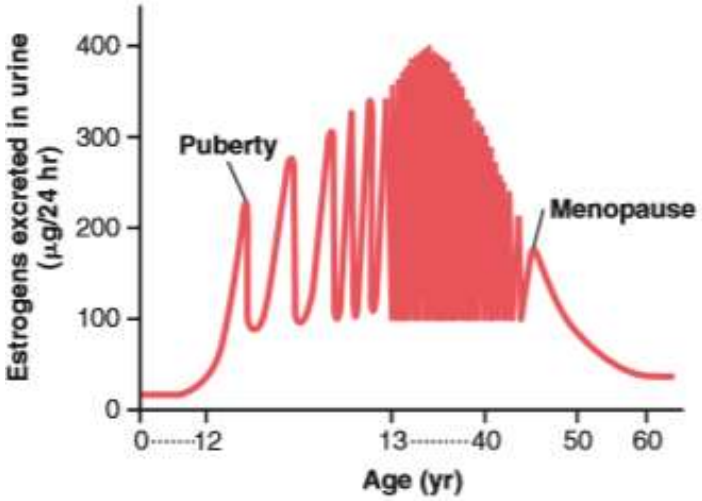
At the age of 40 to 50 years, the sexual cycle becomes irregular, ovulation fails to occur & the cycle ceases

The loss of estrogens causes marked physiological changes in the function of the body including:

1. “hot flushes” characterized by extreme flushing of the skin;
2. psychic sensations and dyspnea;
3. irritability;
4. fatigue;
5. anxiety;
6. occasionally various psychotic states
7. decreased strength and calcification of bones throughout the body.



ıre 82-12. Total rates of secretion of gonadotropic hormones ıughout the sexual lives of female and male human beings, wing an especially abrupt increase in gonadotropic hormones at ıopause in the female.



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.*

- **Hypersecretion by the Ovaries.**

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 and treatment with inhibitors of prostaglandin synthesis).