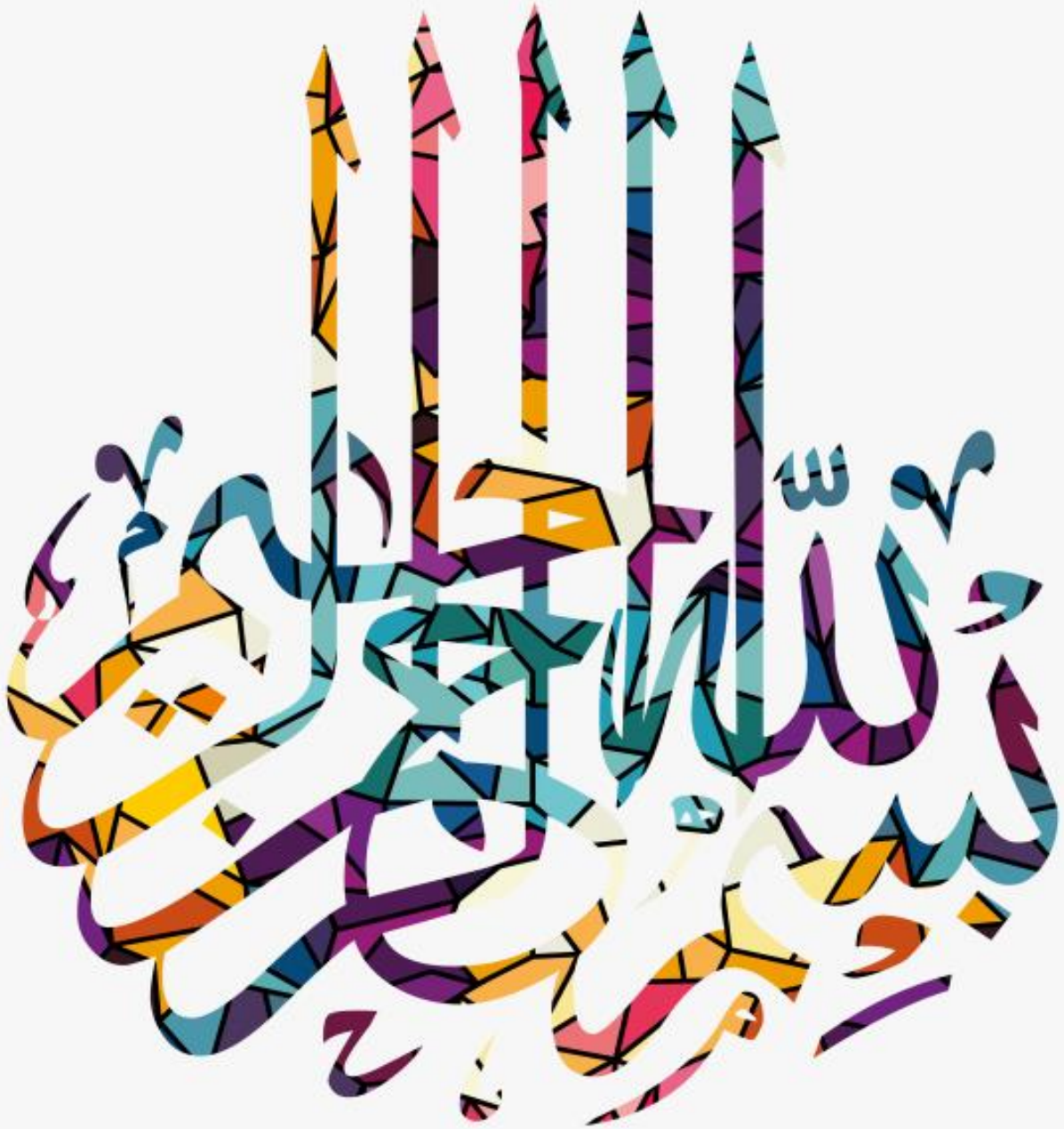

بسم الله الرحمن الرحيم

Female sex hormones

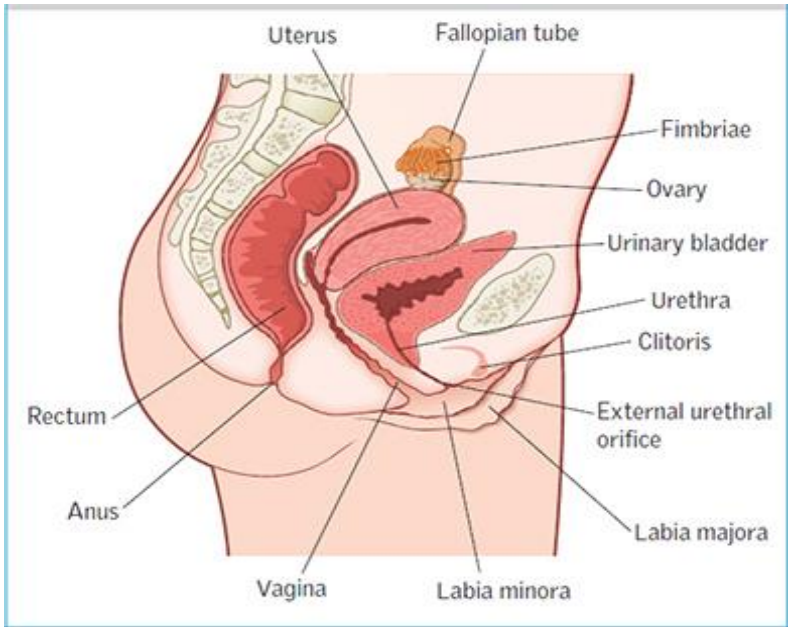
Dr Gulnaz begum

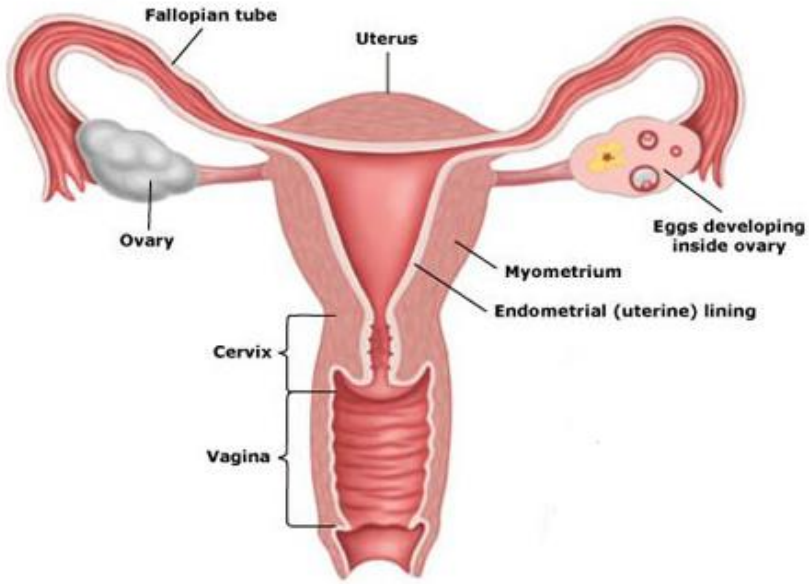
Objectives

- Introduction of female reproductive system.
- Discuss the female hormonal system.
- Discussing ovarian hormones, their mechanism of action, metabolic roles.

Female reproductive organs

- Primary sex organs
- Ovaries, which produce ova & female sex hormones.
- Accessory sex organs
- Internal genitalia; Fallopian tubes (Genital ducts) uterus, cervix & vagina.
- External genitalia; labia majora, labia minora & clitoris.

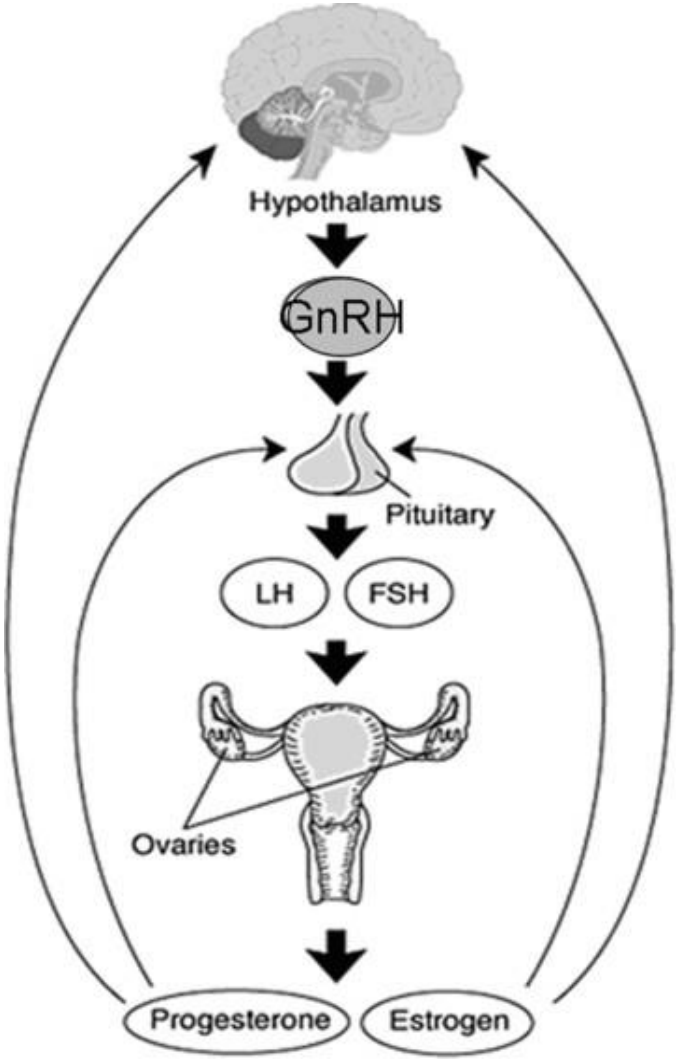




Female reproductive system

- The female reproductive system require

1. The integration of signals from hypothalamus, pituitary & ovary.
2. Repetitive ovarian cycles causing maturation of ovarian follicles followed by ovulation & formation of corpus luteum.
3. In case of fertilization by sperm, preparation of endometrium for implantation.



- Reproductive system of female is different from male.
- In female
- Puberty occur earlier
- Cyclical changes in ovary (ovarian cycles), uterus (endometrial cycle) & vagina.
- Pregnancy & lactation occur.
- Abrupt cessation of reproductive ability at about age of 50-55 years(menopause).

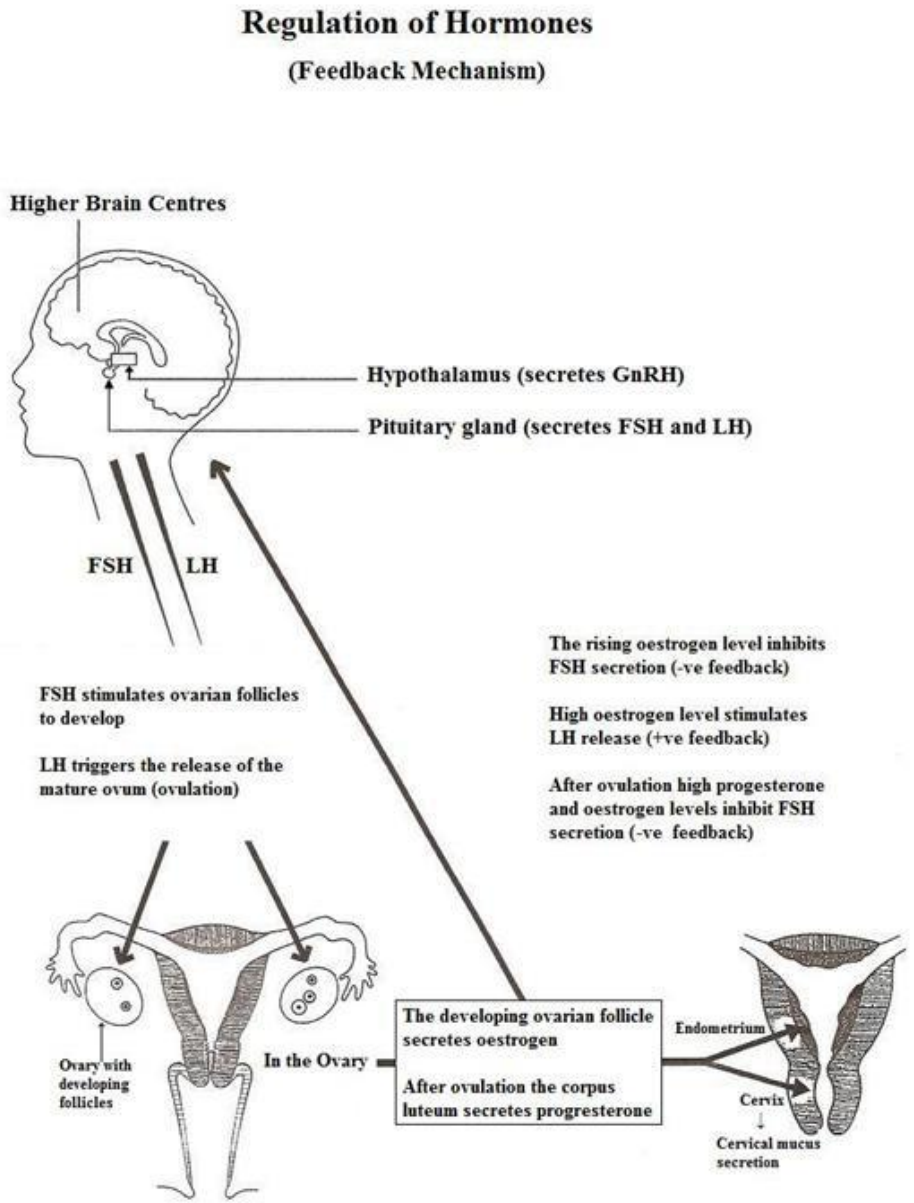
Female Hormonal system

Three groups of hormones

1. GnRH –gonadotropin releasing hormone -hypothalamic releasing hormone

2. Anterior pituitary sex hormones (FSH) & (LH) - secreted in response to GnRH.

3. The ovarian hormones ESTROGEN &PROGESTERONE -secreted by ovaries in response to LH and FSH.



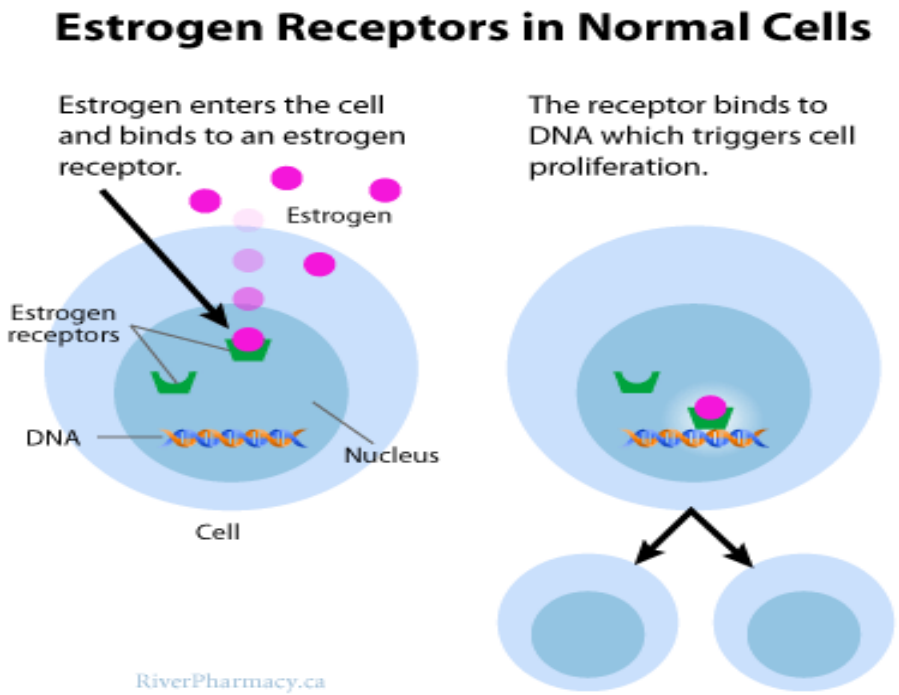
Ovarian hormones

Derived from Greek word

- Estrus ----sexual desire
- Gen ------- to generate
- In the ovary it is secreted by maturing follicles & corpus luteum, and also by placenta.
- Two types
- Steroids (estrogen, progestrone).
- Peptides (inhibin A,inhibin B, Activin, Follistatin, Mullarian inhibiting substances).

Mechanism of action of estrogen

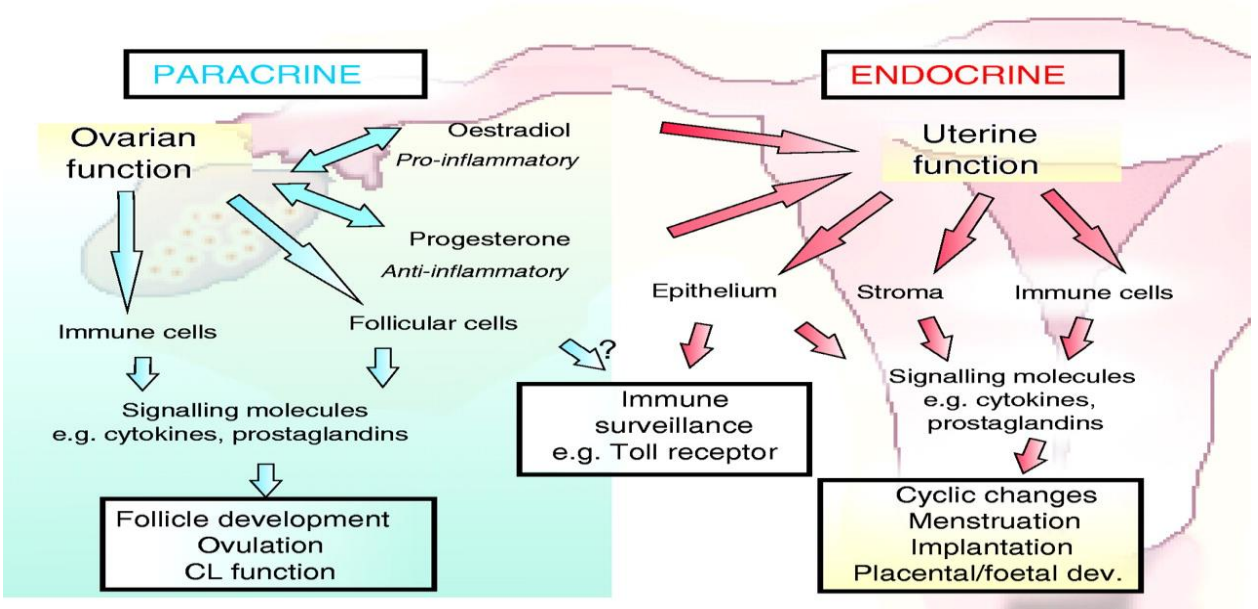
- Found in blood bound with steroid hormone binding proteins(SHBG).
- In the cells bound to its receptors in cytoplasm or nucleus and brings about protein synthesis.



- Effects of estrogen are also mediated by autocrine and paracrine action of

growth factors, lipids and cytokines formed by target cells. These includes rapid estrogen induced effects, e.g

- Greater uptake of Ca^{2+} ions
- Increased uterine blood flow.

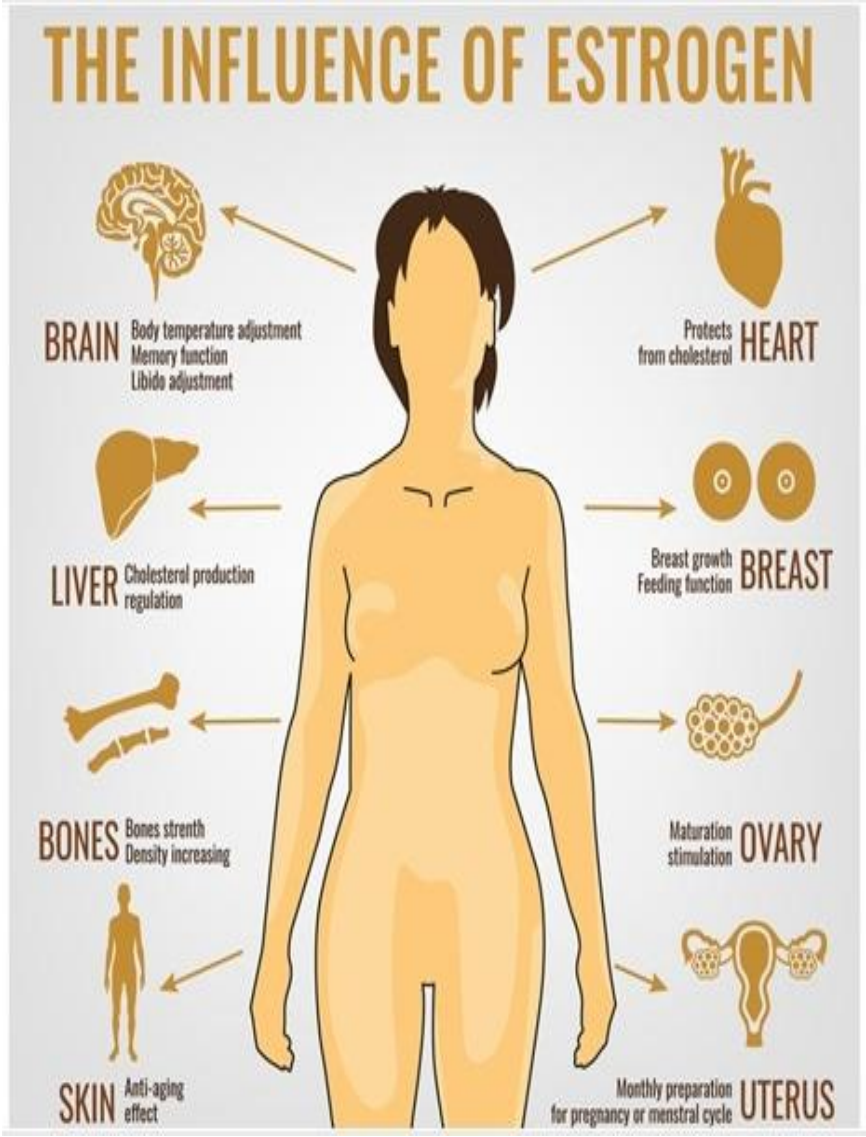


- **Physiological Activity of Natural Estrogens**
- **Reproduction and development of female sex organs**
- **Growth of secondary sex characteristics (male + female)**
- **Role in ovulation and pregnancy**
- **Role in bone density modulation (male + female)**
- **Role in mineral, carbohydrate, protein and lipid metabolism.**

FUNCTIONS OF ESTROGEN

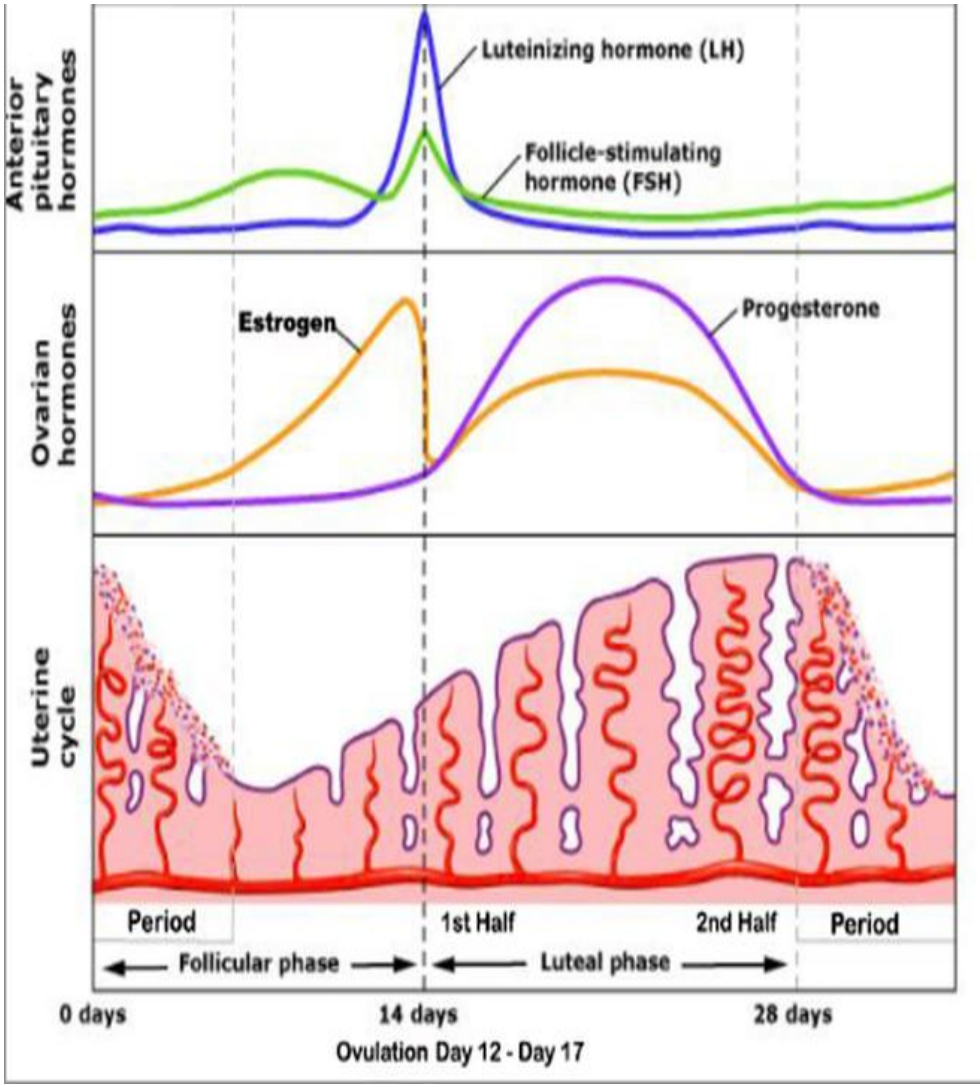
EFFECT OF ESTROGEN ON INTERNAL AND THE EXTERNAL FEMALE SEX ORGANS

- The ovaries , vagina , fallopian tubes , uterus – all increase in size.
- The external genitalia enlarge, with deposition of fat in the mons pubis and labia majora and enlargement of labia minora.
- The estrogens changes the vaginal epithelium from a cuboidal into a stratified type which is more resistant to trauma and infections.



Estrogens cause marked proliferation of the endometrial stroma and greatly increased development of the endometrial glands .

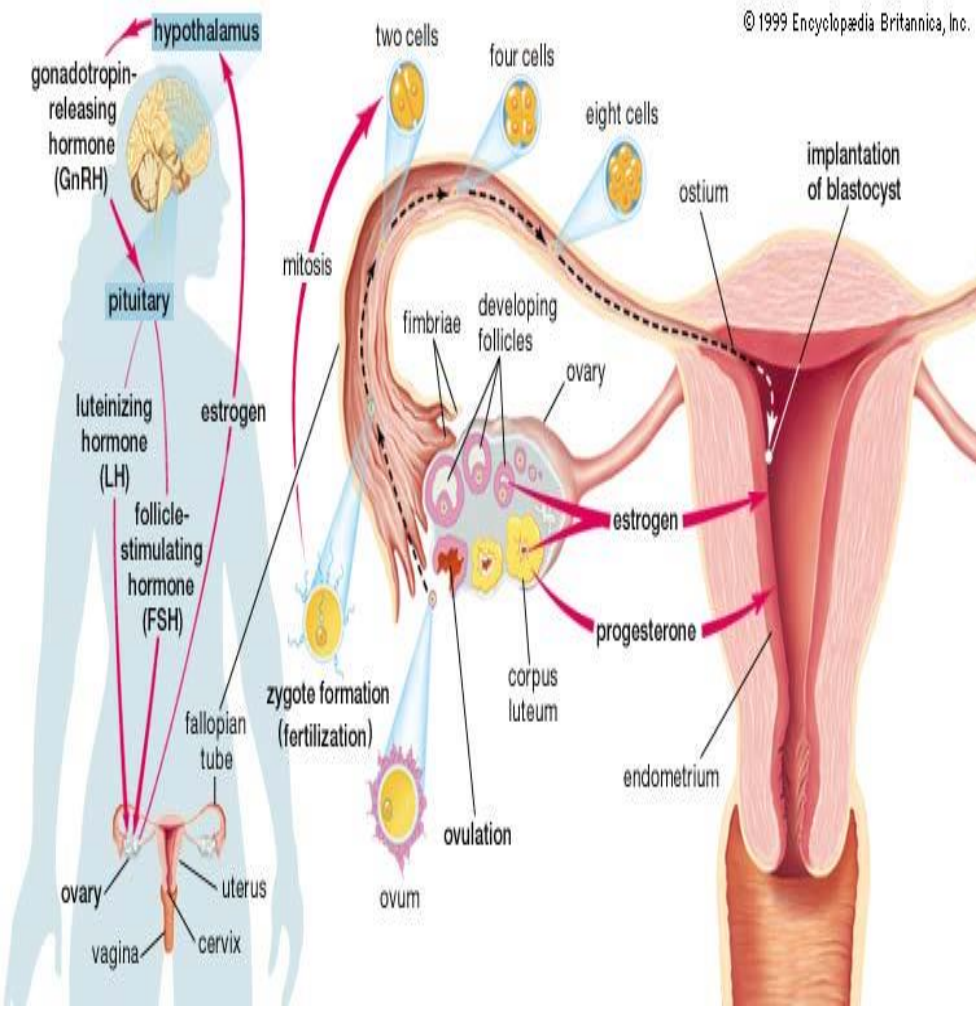
- Increase in glycogen content of cells, which will later aid in providing nutrition to the implanted ovum.



- Increase in alkaline phosphatase activity in endometrium.
- Glycogen also increases in vaginal epithelial cells, with accumulation of lactic acid (LA) .

Effect of Estrogen on the Fallopian tubes

- The estrogens effect on the mucosal lining of the fallopian tubes is similar to that on the uterine endometrium.
- They cause the glandular tissues of this lining to proliferate .
- They cause the number of ciliated epithelial cells to increase which helps propel the fertilized ovum in that direction.



Effect of Estrogen on Breasts

- Development of the stromal tissues of the breasts
- Growth of an extensive ductile system.
- Deposition of fat in breasts.

Effect of Estrogen on the Skeleton

- Estrogens inhibit osteoclastic activity in the bones and therefore stimulate bone growth.

- Estrogens- cause uniting of epiphysis with the shafts of the long bones. As a result growth of the female usually ceases several years earlier than that of male.

Effect of Estrogen on The Skeleton

OSTEOPOROSIS

of bones caused by estrogen deficiency in old age

The estrogen deficiency leads to:

- Increased osteoclastic activity in bones
- Decreased bone matrix
- Decreased deposition of bone calcium and phosphate

Effect of estrogen on protein metabolism

- Estrogens cause a slight increase in total body protein , which is evident by a slight positive nitrogen balance when estrogens are administered

- This mainly results from the growth-promoting effect of estrogen on the sexual organs, the bones and a few other tissues of the body.

- Accelerates incorporation of amino acids into proteins of uterus.
- Increased protein synthesis is mostly preceded by an increase in *RNA polymerase activity and RNA synthesis.*

Effect of estrogen on body metabolism and fat deposition

- Estrogens increase the whole body metabolic rate slightly , but only about one third as much as the increase caused by the male sex hormone – testosterone.
- They also cause deposition of increased quantities of fat in the subcutaneous tissues.
- In addition to the deposition of fats in breasts and subcutaneous tissues, estrogens cause the deposition of fats in buttocks and thighs.
- It also exerts lipotropic effect, so decrease risk of atherosclerosis.

Effect of estrogen on hair distribution

- Estrogens do not greatly affect hair distribution. However, hair does develop in the pubic region.

Effect of estrogen on skin

- Estrogen cause the skin to develop a texture that is soft and usually smooth.
- Also estrogens cause the skin to become more vascular , this is often associated with increased warmth of the skin.

Effect of estrogen on electrolyte balance

- Estrogens like adrenocortical hormones, cause sodium and water retention by the kidney tubules.

- This effect of estrogens is normally slight and rare. But during pregnancy the tremendous formation of estrogens by the placenta may contribute to body fluid retention.

- Causes retention & elevation of Ca & P, so help in calcification of bones.

Effects of estrogen on blood clotting

- Increase in formation of clotting factors like fibrinogen, factor 11, vii ,ix and x
- It decrease anti-thrombin iii level. These effects favor blood clotting.
- Venous thrombosis occurs in women on estrogenic contraceptives.

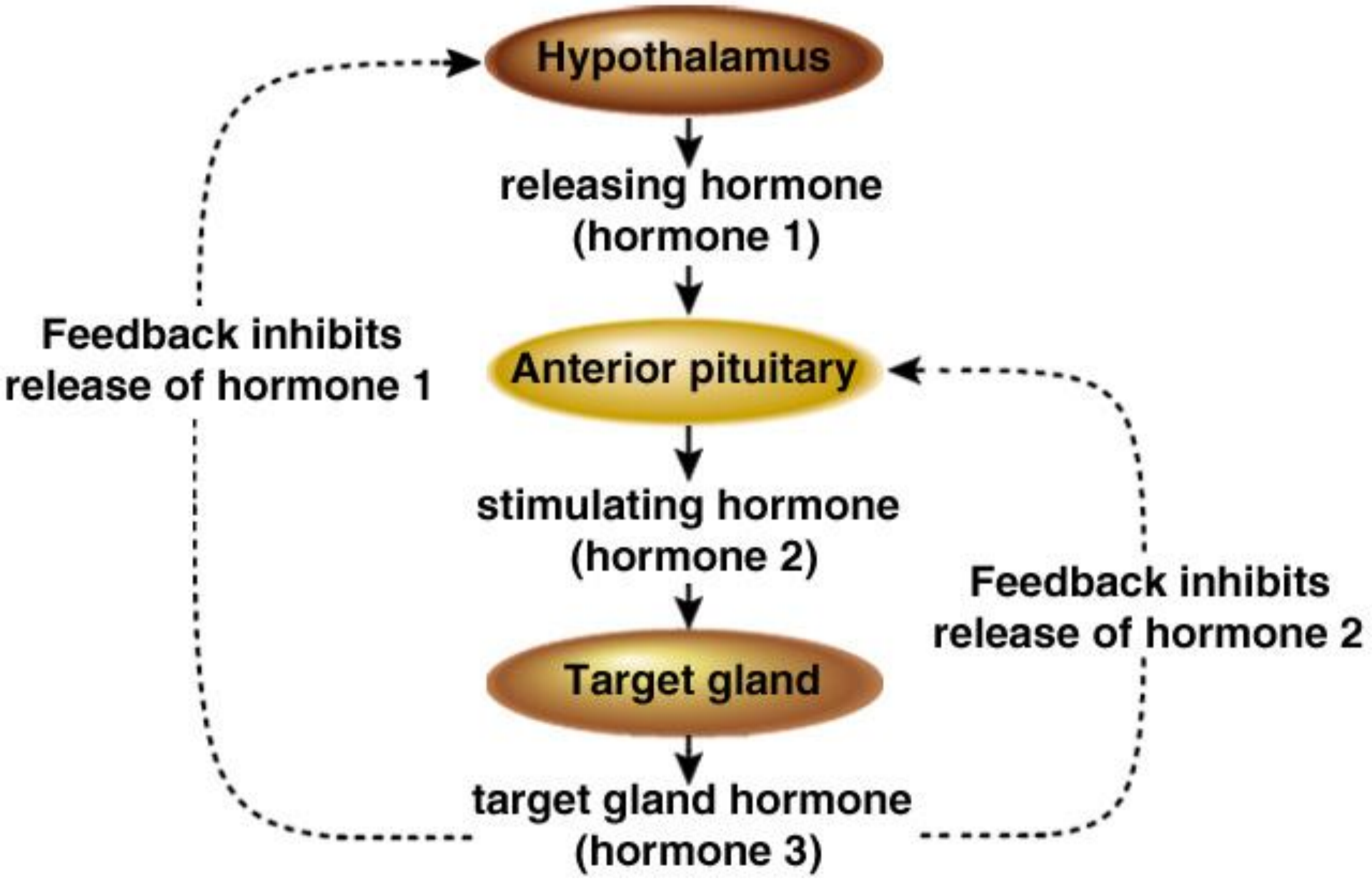
Effects of estrogen on gonadotropin secretion

- Decreases secretion of FSH and LH by
  1. Inhibiting the secretion of GnRH of the hypothalamus
  2. Inhibitory effects on ant. Pituitary.

- Ovarian atrophy due to constant rise in plasma level suppress development of ovarian follicles.

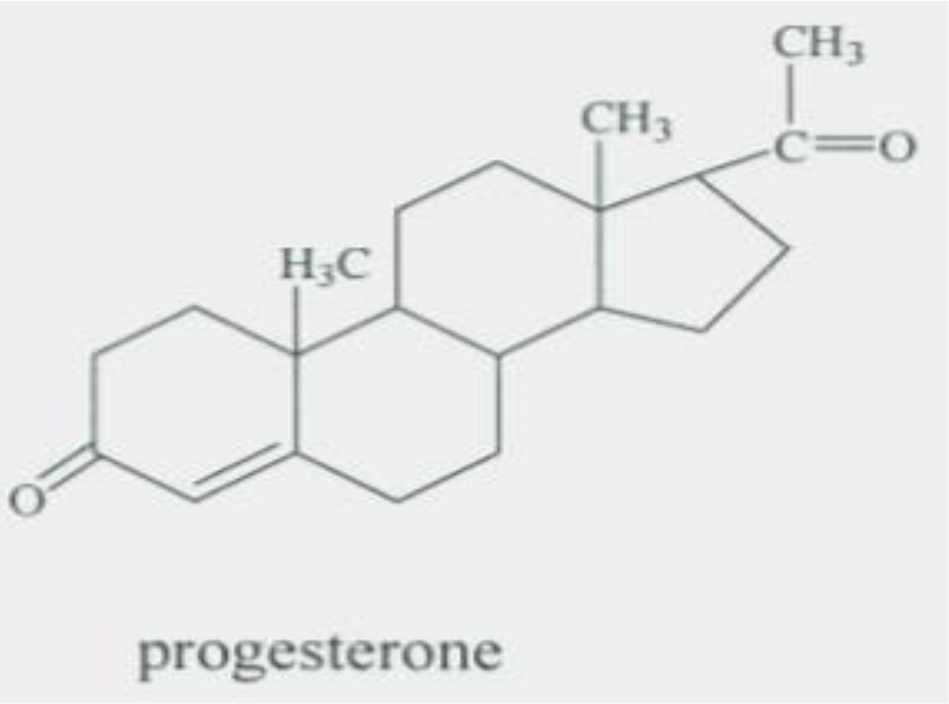
- Pulsatile increase during cycle increases the sensitivity of ant. Pituitary to GnRH & results in pre ovulatory rise in LH.

Endocrine Glands



Effects of overproduction

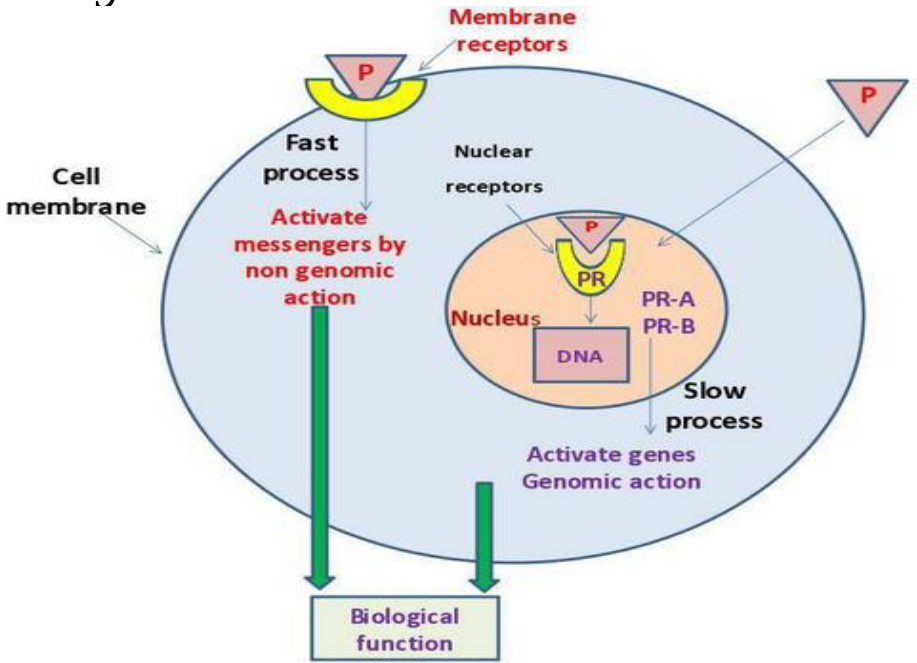
- Ovarian atrophy
- Vaginal adenocarcinoma
- Increase incidence of breast cancer.
- In male benign prostatic hyperplasia.



progesterone

Mechanism of action

- Progesterone has two types of steroid receptors i.e A & B.
- When it bounds with receptor heat shock proteins are removed, allowing the hormone receptor complex to bind with DNA response element & initiate the synthesis of mRNA.



Functions of progestrone

- **Physiological Activity of Progesterone**
- **Maintenance of Pregnancy**
- **Inhibition of follicular maturation and bringing out ovulation**
- **Prevention of spontaneous uterine contractions.**

The progestins

mainly function to prepare the uterus for pregnancy and to prepare the breasts for lactation .

FUNCTIONS OF PROGESTERONE

Effect of progesterone on uterus

To promote secretary changes in the uterine endometrium during the late half of female sexual cycle, thus preparing the uterus for implantation.

It causes increase in glycogen, mucin & fat.

Increases the thickness of cervical mucous.
Converts the vaginal squamous cells into round shape ,filled with mucous.

Effect of progesterone on fallopian tubes

Promotes increased secretion of mucosal lining of fallopian tubes.

Effect of progesterone on breasts

- Promotes development of lobules and alveoli of breasts causing alveolar cells to proliferate , enlarge and become secretary in nature.

Metabolic effects

Increases the mobilization & catabolism of proteins.

Stimulates lipoprotein lipase & increase fat deposition.

Increase basal insulin secretion, cause glycogen storage & promotes ketogenesis.

Increases the reabsorption of Na & water from renal tubules. In large doses cause excretion of Na & water.

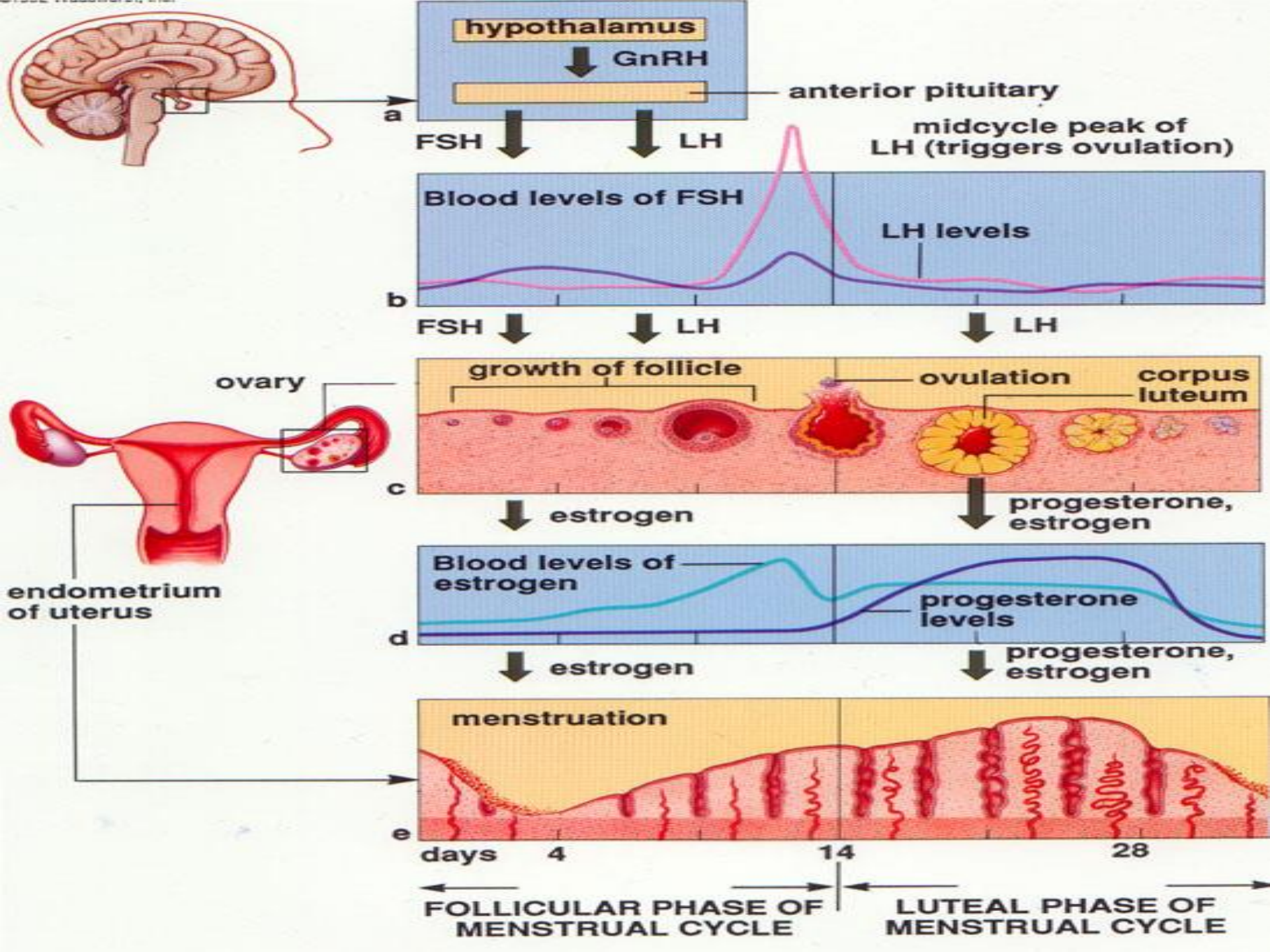
- Thermogenic effect.
- Progesterone is responsible foe rise in body temperature due to increase in BMR.

- Stimulates breathing, during luteal phase of menstrual cycle & pregnancy.

- Weak androgenic activity, due to conversion to androgenic metabolites.

Effects of progestrone

- Inhibits secretion of FSH & LH by feedback inhibition.
- During pregnancy suppress the secreation of prolactin.
- Depressant action on brain.
- Masculinizing effect of female fetus if given during pregnancy.


hypothalamus
GnRH
anterior pituitary
a
FSH
LH
midcycle peak of
LH (triggers ovulation)
Blood levels of FSH
LH levels
b
FSH
LH
LH
ovary
growth of follicle
ovulation
corpus
luteum
c
estrogen
progesterone,
estrogen
endometrium
of uterus
Blood levels of
estrogen
progesterone
levels
d
estrogen
progesterone,
estrogen
menstruation
e
days
4
14
28
FOLLICULAR PHASE OF
MENSTRUAL CYCLE
LUTEAL PHASE OF
MENSTRUAL CYCLE

- Chatterjea
- Satiyanarayn
- Mushtaq Ahmad


thank
you