## UNIT-5 ANATOMY OF FEMALE REPRODUCTIVE SYSTEM, FUNCTIONS OF FEMALE REPRODUCTIVE SYSTEM, SEX HORMONES

Female reproductive system comprises of primary sex organs and accessory sex organs

### PRIMARY SEX ORGANS

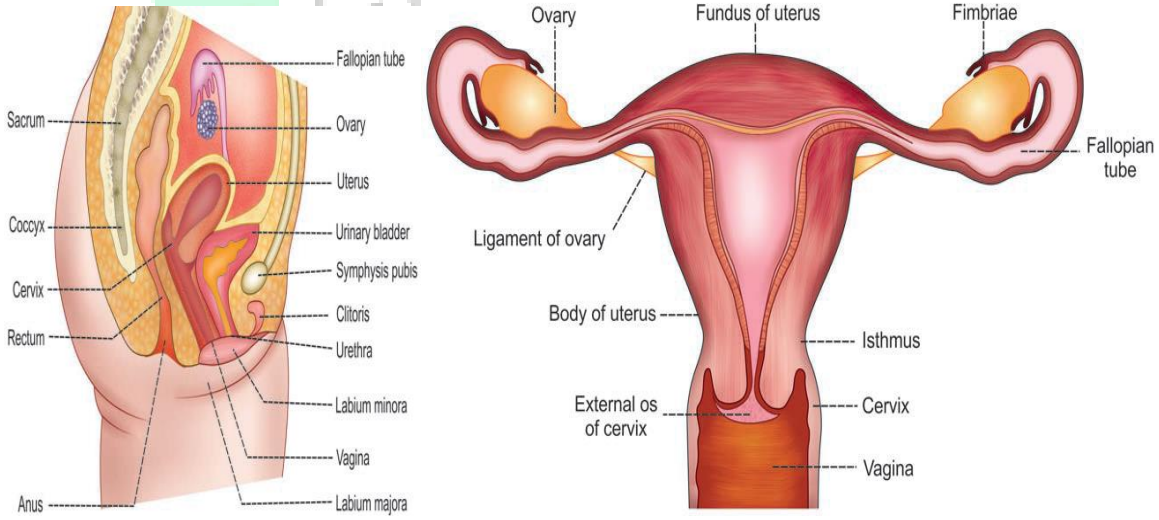
Primary sex organs are a pair of ovaries, which produce eggs or ova and secrete female sex hormones, the estrogen and progesterone.

### ACCESSORY SEX ORGANS

1. *A system of genital ducts: Fallopian tubes, uterus,* cervix and vagina

*2.External genitalia: Labia majora, labia minora and*

clitoris.



## FUNCTIONAL ANATOMY OF ACCESSORY SEX ORGANS

- Uterus is otherwise known as **womb.**
- **It lies in the pelvic** cavity, in between the rectum and urinary bladder.
- Uterus is a hollow muscular organ with a thick wall.
- uterus is pyriform in shape and is flattened anteroposteriorly.
- It measures about 7.5 cm in length, 5 cm in breadth at its upper part and about 2.5 cm in thickness.
- There is a constriction almost at the middle of uterus called **isthmus.**

***Divisions of uterus***

Uterus is divided into three portions:

- 1. Fundus (above the entrance points of fallopian tubes)
- 2. Body (between fundus and isthmus)
- 3. Cervix (below isthmus).

***Structure of uterus***

Uterus is made up of three layers:

1. Serous or outer layer
2. Myometrium or middle muscular layer
3. Endometrium or inner mucus layer.

1. *Serous or outer layer:*

Serous or outer layer is the covering of uterus derived from peritoneum. Anteriorly, it covers the uterus completely, but posteriorly it covers only up to the isthmus.

2. *Myometrium or middle muscular layer:*

- Myometrium is the thickest layer of uterus and it is made up of smooth muscle fibers.

3. *Endometrium or inner mucus layer:*

Endometrium is smooth and soft with pale red color. It is made up of ciliated columnar epithelial cells.

***Changes in uterus:***

- Uterus changes its size, structure and function in different phases of sexual life.
- Just before menstruation, uterus is enlarged, becomes more vascular.
- The endometrium thickens with more blood supply.
- This layer is desquamated during menstruation and reformed after menstrual period.
- During pregnancy, uterus is enlarged very much with increase in weight.
- After parturition (delivery), it comes back to its original size but the cavity remains larger.
- In old age, uterus is atrophied.

***Cervix***

- Cervix is the lower constricted part of uterus. It is divided into two portions:

1. Upper supravaginal portion, which communicates with body of uterus through **internal os (orifice)** of cervix. Mucus membrane of this portion has glandular follicles, which secrete mucus.

2. Lower vaginal portion, which projects into the anterior wall of the vagina and it communicates with vagina through **external os (orifice) of cervix. Mucus** membrane of this portion is formed by stratified epithelial cells.

***Vagina:***

Vagina is a short tubular organ. It is lined by mucus membrane, which is formed by stratified epithelial cells.

**Ovary:**

- Ovary is the gonad or **primary sex organs in females.** A woman has two ovaries.
- Ovaries have two functions, gametogenic and endocrine functions. Gametogenic function is the production and release of **ovum or** egg, which is the **female gamete (reproductive cell).**
- Endocrine function of ovaries is the secretion of female sex hormones.

**FUNCTIONAL ANATOMY OF OVARY**

- Ovaries are flattened ovoid bodies, with dimensions of 4 cm in length, 2 cm in width and 1 cm in thickness.
- Each ovary is attached at hilum to the broad ligament, by means of mesovarium and ovarian ligament.

Each ovary has two portions:

1. Medulla

2. Cortex.

**MEDULLA**

- Medulla or zona vasculosa is the central deeper portion of the ovary.
- It has the stroma of loose connective tissues.
- It contains blood vessels, lymphatics, nerve fibers and bundles of smooth muscle fibers near the hilum.

„ **CORTEX**

- Cortex is the outer broader portion and has compact cellular layers.
- It is interrupted at the hilum, where the medulla is continuous with **mesovarium.**
- **Cortex is lined** by the germinal epithelium underneath a fibrous layer known as **'tunica albuginea'.**

Cortex consists of the following structures:

i. Glandular structures, which represent ovarian follicles at different stages

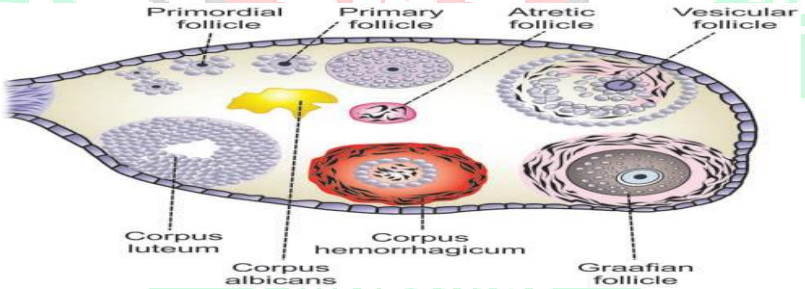
ii. Connective tissue cells

iii. Interstitial cells, which are clusters of epithelial cells with fine lipid granules formed mainly from theca interna.

***Ovarian Follicles***

- In the intrauterine life, outer part of cortex contains the **germinal epithelium, which is derived from the germinal ridges.**
- **When fetus develops, the germinal** epithelium gives rise to a number of primordial ova.
- The primordial ova move towards the inner substance of cortex.
- A layer of spindle cells called **granulose cells** from the ovarian stroma surround the ova.
- Primordial ovum along with granulosa cells is called the **primordial Follicle.**

- At 7th or 8th month of intrauterine life, about 6 million primordial follicles are found in the ovary.
- But at the time of birth, only 1 million primordial follicles are seen in both the ovaries and the rest of the follicles degenerate.
- At the time of puberty, the number decreases further to about 300,000 to 400,000.
- After menarche, during every menstrual cycle, one of the follicles matures and releases its ovum.
- During every menstrual cycle, only one ovum is released from any one of the ovaries.
- During every cycle, many of the follicles degenerate.
- The degeneration of the follicles is called **atresia and** the degenerated follicles are known as **atretic follicles.**
- The atretic follicles become fibrous and the fibrotic follicles are called the **corpus fibrosa.**




## Functions of Ovaries

Ovaries are the primary sex organs in females. Functions of ovaries are:

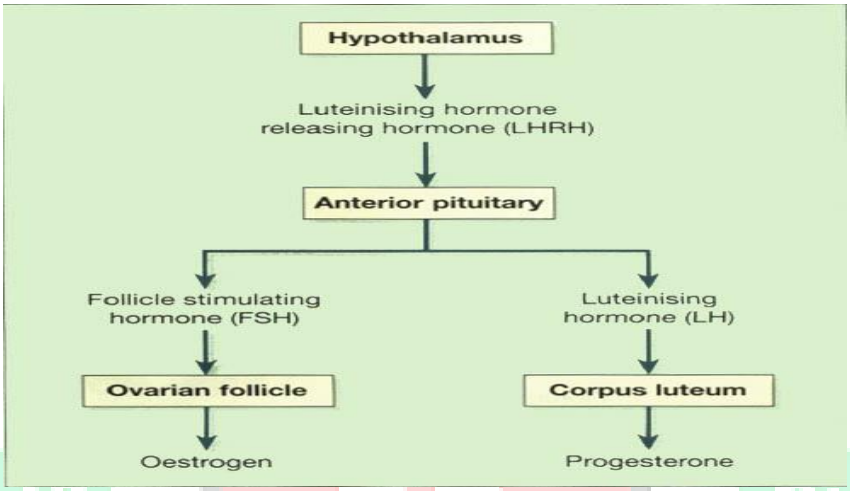
1. Secretion of female sex hormones

2. Oogenesis

3. Menstrual cycle.

## 1. OVARIAN HORMONES

Ovary secretes the female sex hormones estrogen and progesterone.




## ESTROGEN

***Source of Secretion***

- In a normal non-pregnant woman, estrogen is secreted in large quantity by theca interna cells of ovarian follicles and in small quantity by corpus luteum of the ovaries.
- Estrogen secretion is predominant at the later stage of follicular phase before ovulation.
- Estrogen is derived from androgens, particularly androstenedione, which is secreted in theca interna cells.
- Androstenedione migrates from theca cells to granulosa cells, where it is converted into estrogen by the activity of the enzyme aromatase.

### FUNCTIONS OF ESTROGEN

- Major function of estrogen is to promote cellular proliferation and tissue growth in the sexual organs and in other tissues, related to reproduction.A few functions are discussed below

**1. *Effect on Ovarian Follicles***

- Estrogen promotes the growth of ovarian follicles by increasing the proliferation of the follicular cells.

**2. *Effect on Uterus***

Estrogen produces the following changes in uterus:

i. Enlargement of uterus to about double of its childhood size due to the proliferation of endometrial cells

ii. Increase in the blood supply to endometrium

iii. Deposition of glycogen and fats in endometrium

iv. Proliferation and dilatation of blood vessels of endometrium

v. Proliferation and dilatation of the endometrial glands, which become more tortuous with increased blood flow

vi. Increase in the spontaneous activity of the uterine muscles and their sensitivity to oxytocin

vii. Increase in the contractility of the uterinemuscles.

All these changes prepare uterus for pregnancy

## PROGESTERONE

***Source of Source of Secretion***

- In non-pregnant woman, a small quantity of progesterone is secreted by theca interna cells of ovaries during the first half of menstrual cycle, i.e. during follicular stage.

- But, a large quantity of progesterone is secreted during the latter half of each menstrual cycle, i.e. during secretory phase by the corpus luteum.

## FUNCTIONS OF PROGESTERONE

- Progesterone is concerned mainly with the final preparation of the uterus for pregnancy and the breasts for lactation. A few functions are discussed below

### 1. *Effect on Fallopian Tubes*

- Progesterone promotes the secretory activities of mucosal lining of the fallopian tubes.
- Secretions of fallopian tubes are necessary for nutrition of the fertilized ovum, while it is in fallopian tube before implantation

### 2. *Effect on the Uterus*

- Progesterone promotes the secretory activities of uterine **endometrium during the secretory phase of** the menstrual cycle.
- Thus, the uterus is prepared for implantation of the fertilized ovum.

### 3. *Effect on Cervix*

- Progesterone increases the thickness of cervical mucosa and thereby inhibits the transport of sperm into uterus.
- This effect is utilized in the contraceptive actions of minipills.