

## Chapter - 28

# Reproductive System of Human

The process of producing offspring's in organisms is called reproduction. Sexual reproduction occurs in human. They have sexual dimorphism means on the basis of external features male and female can be identified. Male has penis and scrotal sac whereas mammary glands are developed in female. These are only in vestigial form in males. Beard and moustache, heavy voice like characters are found in men, while in women sweet voice, soft skin and more developed pelvic region due to deposition of fat around buttocks etc. are main characteristics of women.

### Male Reproductive System

Male reproductive system has two main components—Primary reproductive organs and accessory reproductive organs. One pair of testes is present as primary gonads in males. Beside this there are many accessory reproductive organs mainly scrotal sac, Epididymis, vas deference, penis, Prostate gland, Cowper's gland is found (Fig: 28.1)

#### Testes

In adult man, one pair of pinkish, oval shaped testes are present in sacs in between both legs outside the abdominal cavity. The wall of scrotal sac is flexible, thin and hairy and its sub cutaneous layer of thick fibers of unstriped muscle fibers is present in its inner side which is known as **Dartos muscle**. A rod shaped bunch of striated muscles fibers joins the subcutaneous muscle layer of each half of scrotal sac with abdominal sub cutaneous muscle which is called **Cremaster muscle**. A narrow **inguinal canal** is connected with the each scrotal sac cavity.

#### Structure and Functions of Testes

Each testis is a structure of about 4 cm thick, 2.5 cm long and about 10 to 15 gm in weight. Testes have two covers which are known as **Testicular capsule**. Its outer thin cover is called **Tunica vaginalis**. It is made up of abdominal cover of abdominal cavity while inner layer is called **Tunica albuginea** which is made up of white fibrous connective tissue. This layer enters in testes at various places and form septula testes. Each testis is divided into 250-300 lobules. Two or three coiled seminiferous tubules are present in lobular tissue. Beside these tubules, endocrine cells, blood capillaries and nerve fibers are present in lobular tissue. Interstitial cells or leydig cells are present in these connective tissues which secretes male hormone testosterone due to which secondary sexual characters and accessory reproductive glands are developed in men.

A thin membranous covering of connective tissues is present around each seminiferous tubule which is called Tunica propria. In side it a layer of germinal epithelium is present, which have two types of cells—

**(I) Spermatogonial cells**— They form sperms by spermatogenesis.

**(ii) Supporting cells** – These are also called sertoli cells or Nurse Cells. These cells are less in number, large in size and columnar type. The part of its free surface is chopped. In this part spermatids remains attached with sertoli cells. Besides providing protection, support and nourishment to

developing germ cells sertoli cells degenerate unnecessary cytoplasm of spermatid. Protein hormone inhibin is also secreted by these cells for regulating the activity of FSH by which sperm production is induced.

Seminiferous tubules begin from the surface of testis and being less coiled in middle area become straight and open into dense network of small tubules, which are called **Rete testis**. About 15-20 convoluted ductules originate from it. Which are called Vasa **efferentia**. These ductules reach the upper surface of testis and opens into a long epididymis. Inner layer of seminiferous tubules is made of ciliated columnar epithelial cells outside of which a thin circular muscular layer is present.

In most of mammals including human testis are found in scrotal sac outside the abdominal cavity because maturation of sperm in abdominal cavity is not possible due to high temperature. The temperature in scrotal sac is  $2^{\circ}$  -  $2.5^{\circ}\text{C}$  lesser than body temperature. By which maturation of sperms becomes easily possible.

In winter, temperature of scrotal sac begins to decrease then Dartos muscles and cremaster muscle contracts scrotal sac and pull much near to abdominal cavity so the temperature of testes remains constant due to body temperature.

## 2. Epididymis

It is a thin, about 6 meters long, much coiled, flat, comma shaped tube. Its coils are attached with each other by connective tissue. Its wall has thick layer of muscles towards outside and inner layer is lined by stratified epithelium. This tube is divided into three parts.

**(i) Caput epididymis**– This part is wide and lying on upper side of testis, vasa efferentia opens in this part.

**(ii) Corpus epididymis** – It is middle and narrow part, which is thin and flat and extends up to lower surface of testis.

**(iii) Cauda epididymis** – It is last part which is thin and covers the lower portion of testes.

## 3. Vas Deferens –

Vas Deferens is about 45 cm long tubes. Cauda

epididymis becomes less coiled and straight thick tube forms vas deferens. Inner layer of vas deferens is made of pseudo stratified columnar epithelium. Some cells of it secrete special fluid by which keep the passage of vas deferens smooth for sperms movement. The sperms move forward due to wave motion in the muscles of its wall. Vas deferens starts from the posterior part of epididymis, passes through inguinal canal enters in the abdominal cavity turn down- ward the posterior part of urinary bladder and at last form a swollen part called ampulla. Here small vessels of seminal vesicle open. Both collectively form an ejaculatory duct.

Sperms are temporarily stored in ampulla. Ejaculatory ducts finally open in urethra.

## 4. Urethra –

After arising from urinary bladder ureter joins with ejaculatory duct to form urinogenital duct or urethra. It is about 20 cm long duct which opens at tip of penis as urinogenital aperture.

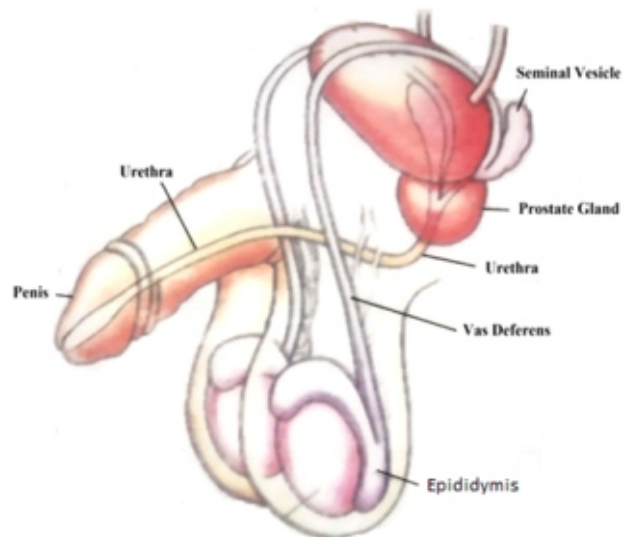


Fig. 28.1 Male reproductive system

## 5. Accessory Reproductive Glands

Mainly three types of accessory reproductive glands are found in men which release their secretions in urinary tract. All these secretory substances along with secretions of epididymis and seminal vesicle and sperm form semen. Male have following accessory reproductive glands.

**(I) Prostate Gland** – This gland is situated at

the base of urinary tract. Light whitish alkaline fluid is secreted by prostate gland which forms 25-30 percent part of semen. This liquid contains phosphatase, citrate, lysozyme, fibrinolysis, spermin etc. It activates sperms and prevents coagulation of semen. In old age, the size of prostate enlarges due to which difficulty arises in urination.

**(ii) Seminal Vesicles**– These are a pair of sac like structures situated between the surface of urinary bladder and rectum. It is a yellowish, sticky liquid substance secreting gland. A small duct arises from each seminal vesicle, opens in ampulla of vas deferens. At the time of ejaculation in erectile position of penis, both seminal vesicles constrict and release their secretions. The secretion of seminal vesicles constitutes about 60 percent part of semen. It contains fructose, sugar, prostaglandins and protein semenogelin. Fructose provides energy to sperms in the form of ATP. Due to alkaline nature this secretion neutralizes the acidity of vaginal tract and provides safety to sperms.

**(iii) Cowper's gland or Bulbourethral Gland** – Just below the prostate gland, on both sides of urinary tract there are one small oval shaped gland called Cowper's gland is present. At the time of mating, dense sticky, alkaline transparent fluid is secreted by these glands which make the urinary tract smooth and slightly alkaline by neutralizing the acidity of urinary tract. This liquid makes the intercourse easy by lubricating the vagina of female.

## 6. Penis –

In middle of scrotal sac and hanging from the abdomen, a long, cylindrical erectile and richly vascularized copulatory organ is found in human and other mammals which is called penis. It is covered by a thin abdominal wall.

The body of penis is consist of three spongy longitudinal chords of fibrous and muscular connective tissues. Out of these, two thick chords are in dorsolateral part of penis and one thin chord is in ventral side around the urinary tract. The chords of dorsal part are called **corpora cavernous** and ventral part's chord is called **corpus spongiosum**. The tip of penis is swollen and forms Glans-penis. It is formed of only corpus spongiosum. The skin covers glans penis forms a cap like structure which

is known as Prepuce. It is folded at the base of glans-penis during copulation.

In normal condition blood sinuses in three chords remains empty and muscles are constricted. At this time only urine is passed out from urinogenital aperture. In the excited state for copulation, the blood fills up in sinuses of spongy chords by arteries of penis, muscles relaxed and penis becomes swollen, long and hard. Glans part becomes necked. The erection of penis depends on blood circulation. In excited state, the penis reaches deep into vagina so at the time of copulation released sperms can reach in uterus easily.

## Female reproductive System

One pair of ovaries is found in the form of primary reproductive organs in women. Beside these, a pair of oviduct, uterus, vagina, vulva, breast and reproductive glands acts as accessory reproductive organs (Fig : 28.2)

### 1. Ovary

In women almond shaped two ovaries are situated in abdominal cavity. Each ovary is 1.5 to 3 cm long and 8 mm thick and attached by mesovarium (mesentery) with dorsal side wall of abdominal cavity behind kidney in pelvic region. The production of ova and female hormones estrogen and progesterone are secreted by ovary.

Internally the ovary is a dense and solid organ which is divided into a thick dense outer part **cortex** and comparatively loose internal part **medulla**. Outermost layers in ovary is visceral peritoneum, inner part is thin, whitish tunica albuginea, made of connective tissue and in between these, there is a single layer germinal epithelium of cuboidal cells. The substance of cortex and medulla is called stroma which is made of connective tissue fibres.

Elastin fibres, non-striated muscular fibres, blood vessels and many ovarian follicles or graafian follicles in various stages of maturation are found in cortical region of stroma. Ovarian follicle grows in size by division of follicular cells. Among these cells, one cell enlarges rapidly and form ovum. Remaining cells are called follicle cells. Mature follicle is called Graafian follicle. A thin, transparent layer **zona pellucida** is formed outside the oocyte.

Outside of which the columnar cells form a layer **corona radiata**. During the growth phase of Graafian follicle, follicular cavity or antrum is formed among follicle cells of membrana granulosa in which a colourless fluid liquor folliculi is filled. At one place of Graafian follicle follicular cavity is not formed. In this part oocyte containing structure is attached with wall of follicle by a connective tissue mass of membrana granulosa cells. This mass is known as **Discus proligerus** or **Cumulus oophorus**.

In the last phase of development of Graafian follicle first maturation division occurs in primary oocyte by which it is converted into secondary oocyte. In this stage ovulation occurs in most of mammals including human. During ovulation ovum comes out after rupturing of mature follicle. After this cells of ruptured follicle form a yellow coloured glandular structure **Corpus luteum**. It also remains after fertilization of ovum. Corpus luteum acts as temporary endocrine gland. Progesteron and estrogen hormones are secreted by it which activates uterus and mammary glands. Both ovaries of an adult lady have about four lakh Graafian follicles. After degeneration most of them are extruded with secretion of menstrual cycle (average period of 28 days).

## 2. Oviduct

About 12 cm long, funnel shaped and coiled muscular tube is closely related with each ovary, which is called **Fallopian tube**, **oviduct** or **uterine tube**. Fallopian tube is extended from its own side near ovary to uterus of which its anterior funnel shaped part is attached with ovary, is called infundibulum. Around the edge many finger like projections are present which are called fimbriae. Aperture like mouth of infundibulum is known as ostium.

The wall of oviduct is contractile and lined internally by ciliated epithelium. A thin layer of dense, thick sticky fluid is secreted by secretory mucosal epithelium of it which provides nutrition and protection to ovum. Posterior part of oviduct opens into uterus. The ovum released from ovary, enters oviduct through fimbriae.

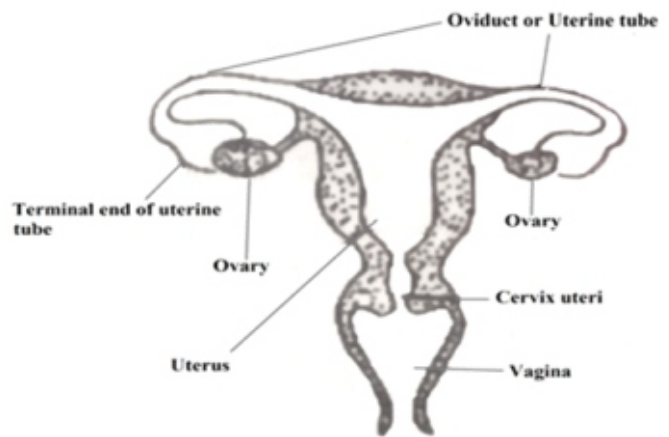


Fig. 28.2 Female reproductive system

## 3. Uterus

It is pear shaped hollow organ which is present in middle of pelvic region. Three strong ligaments held it in pelvic cavity. Normally its size is 7.5x50x2.5 cm. The oviducts of both side open in it. The uterus wall is thick and much vascular. A layer of muscosal epithelium is found on the surface of uterine cavity which is called **Endometrium**. Outside of mucosa a thick muscular layer made of smooth muscles is found which is called **Myometrium**. The upper main part of uterus is comparatively wide and having triangular cavity which is called body and its lower narrow part is known as cervix uteri. It opens into vagina by an external orifice. Embryo which is formed after fertilization remains attached with uterus wall, where protection and nutrition are provide to it.

## 4. Vagina

Cervix uteri growand forms a flexible muscular membranous tube like structure called vagina. The cells of vagina wall store glycogen. The mucous present in vagina becomes acidic by fermentation by **Lactobacilli** bacteria present in vagina which provides protection from infection. Vaginal opening is partially closed by a thin membrane called **Hymen**. It ruptures due to extreme physical work, sexual contact and exercise.

Besides working as copulatory organ vagina provides passage for menstrual discharge and acts as birth canal during birth of child.



## 5. Vulva

All external genitalia of female are collectively called **vulva**. These are situated just above perinaeum in pelvic region. Vulva includes following structures (Fig : 28.3)

- I. **Mons pubis or Mons veneris**- It is skin covered adipose tissue containing out growth and is situated above pubic symphysis.
- II. **Labia Majora**– These are one pair of longitudinal folds that extend downward and backward from below the Mons pubis which are formed by adipose tissue and covered with skin. Hairs are present on its outer surface.
- III. **Labia Minora** – These are one pair of small folds present between labia majora which are formed of pigmented skin and surround the vestibule.
- IV. **Clitoris** – It is a sensory and erectile organ found below Mons pubis and anterior corner of labia minora. It is homologous organ to male penis.

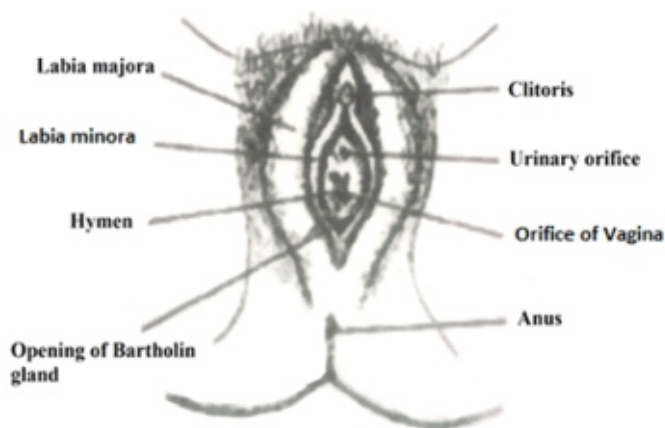


Fig. 28.3 Vulva part of female

- V. **Vestibule** – A fissure like place situated between labia minora is called vestibule. Urinary tract and vagina open in it by their respective orifices. Urinary orifice or meatus is present in the form of small pore, just below the clitoris. Below this orifice, the orifice of vagina is situated

Changes in male and female at onset of puberty	
MALE	FEMALE
<ol style="list-style-type: none"> <li>1. Growth in size of penis, scrotal sac, prostate gland and seminal vesicle</li> <li>2. Growth in size of testes and spermatogenesis begins</li> <li>3. Voice becomes heavy</li> <li>4. Hairs grow on different areas of body like face (beard and moustache), chest and pelvic part.</li> <li>5. Fast growth of body and growth in pectoral region.</li> <li>6. secretion of testosterone, FSH, LH etc. hormones increase</li> <li>7. Psychological attraction towards female</li> </ol>	<ol style="list-style-type: none"> <li>1. Growth in size of uterus, vagina, oviduct and vulva</li> <li>2. Mammary glands grow on breast and menstrual cycle with menarche begins</li> <li>3. Voice becomes thin, acute and sweet.</li> <li>4. Absence of hairs on body.</li> <li>5. Fast growth in pelvic region. A buttock becomes wide, growth of breast and storage of fat in body.</li> <li>6. Secretion of progesterone, Estrogen, FSH LH etc. hormones increases.</li> <li>7. Psychological attraction towards male.</li> </ol>

**VI. Bartholin's glands or Greater Vestibular Glands-** One both sides of vaginal orifice, one bean shaped gland is situated on labia majora. These glands secrete an alkaline and lubricating fluid which keeps the vulva wet and makes the sexual intercourse easy.

#### **6. Breast –**

Breasts act as accessory organs of female reproductive system. A pair of breasts containing mammary glands is present in female. These are situated on pectoral muscle on front side of chest. The inner connective tissue of each breast is composed of 15-20 lobes among these adipose tissue is found. Each lobe contains mammary glands like the bunch of grapes which secrete milk. This milk provides nutrition to new born baby. Many small ducts emerge out from each lobe collectively forms lactiferous duct. Many such lactiferous ducts open separately in nipple. A nipple is pigmented structure found on the top part of mammary glands. The area around it is also densely pigmented. This area is called Areola mammae. Due to deposition of fat and presence of muscles the area around nipple is with much outgrowth in female. Nipple has 15-25 pores of 0.5 mm diameter.

The growth and function of mammary glands are controlled by somatotropin, Prolactin, Estrogen, Progesterone, Oxytocin etc. hormones. The milk contains fat, lactose, Casein, lysozyme, calcium, vitamins and many other important immunity providing substances. Mother's milk is important product providing complete nourishment to child. It provides protection to baby against many infections etc.

Females have more responsibilities than males in reproduction because many important functions are conducted by female reproductive system i.e. ovum production, receiving sperms at the time of mating, to create favorable environment for fertilization, to provide nutrition to child during embryonic stage and after parturition synthesis and secretion of milk by mammary glands after birth etc.

#### **Onset of Puberty in Human**

The development of reproductive capacity by maturation of immature male and female

reproductive organs in human is called **Puberty**. Puberty starts earlier in female as compared male. The puberty begins in male at the age of 14-16 years with activation of testes and spermatogenesis while in female; it begins at the age of 12-16 years with the development of mammary glands and menarche.

#### **Important Points**

1. Male and female can be identified by morphological characters. It is called sexual dimorphism.
2. Primary reproductive organs in female are ovaries and in testis in male.
3. Formation of sperms occurs by seminiferous tubules in testes.
4. Leydig cells of testes secrete testosterone and Graafian follicle cells secrete estrogen in female.
5. Maturation of sperms occurs in epididymis of testes.
6. Activation of uterus and mammary glands depend on progesterone and estrogen secreted by corpus luteum.
7. Menstrual cycle in females completes in average of 28 days.
8. Growing of beard and moustache, dense hairs on body, heavy voice, and growth of scrotal sac are the characters of onset of puberty in male. These are called secondary sexual characters.
9. Softness of skin, growth of mammary glands, lack of hairs on body, thin and sweet voice etc. are the secondary sexual characters of female.
10. Progesterone hormone is secreted by corpus luteum.

#### **Practice Questions**

##### **Multiple Choice Questions-**

1. Where Graafian follicles are found?
  - (a) In thyroid of human
  - (b) In prostate of human
  - (c) In ovary of female
  - (d) In testes of male.

2. The gland which secretes alkaline fluid that lubricates the vagina at the time of mating is-  
 (a) Prostate (b) Rectal  
 (c) Cowper (d) Perineal
3. After how many days menstrual cycle occurs in women-  
 (a) 14 days (b) 20 days  
 (c) 32 days (d) 28 days
5. Write short notes on following –  
 (1) Ovary  
 (2) Penis  
 (3) Epididymis  
 (4) Secondary sexual character  
 (5) Corpus luteum

**Answer Key-**

1. (c) 2. (c) 3. (d)

**Very short Answer Questions-**

1. Write function of corpus luteum.
2. Which cells act as endocrine gland in testes?
3. Write name and function of hormone secreted by leydig cells.
4. Write name of primary reproductive organs of male and female human.
5. What is the name of mucous membrane found at the surface of internal cavity of uterus?
6. Write two secondary sexual characters of woman.

**Short Answer Questions-**

1. What changes are visible in male and female human at onset of puberty?
2. Scrotal sacs constrict and become small in winter. Explain
3. What is ageing?
4. What do you mean by sertoli cells, what are their functions?
5. Explain with labelled diagram of mammary glands of women, how it is helpful in reproduction?
6. Draw a labelled diagram of transverse section of testes and write function.

**Essay Type Questions-**

1. Describe male reproductive system of human with labelled diagram.
2. Explain the structure of ovary
3. Describe different accessory glands of male and female reproductive system of human helpful in reproduction?
4. Describe with diagram female reproductive system of human.