

C.W
Chapter - 3
Human Reproduction

Male Reproductive System

The male reproductive system consists of following:-

- (i) Primary sex organ:- testes,
- (ii) Secondary sex organ:-
 - (a) Accessory ducts:- vasa testis, vasa deferentia, epididymis and vas deferens
 - (b) Accessory glands:- seminal vesicle, prostate and bulbourethral glands
- (iii) External genitalia:- penis

- (i) Testes → Testes are situated outside the abdominal cavity within a pouch called scrotum, which helps in maintaining the low temp. of testes which is necessary for synthesis of sperms. Testes are oval in shape, measures about 4-5 cm in length and 2-3 cm in width.

Each testis has about 250 testicular lobules and each lobule contains highly coiled seminiferous tubules in which sperms are produced.

Each seminiferous tubule is lined by two types of cells, spermatogonia and Sertoli cells.

Leydig cells and interstitial cells present around the seminiferous tubules synthesise and secrete androgen hormone.

(ii) Accessory Duct System → The seminiferous tubules open into vasa efferentia through rete testis. Several vasa efferentia open into the epididymis and carry sperms outside the testes.

Epididymis is a long, coiled tube present along the posterior surface of each testis. It continues as vas deferens and ascends into the abdomen to loop over urinary bladder.

The duct from seminal vesicle and vas deferens together form ejaculatory duct. They carry secretions of seminal vesicle and sperm from the testis to outside through urethra.



Urethra originates from urinary bladder and it carries urine from the bladder and sperms from vas deferens through the penis.

(iii) Accessory Glands → It includes a prostate gland, two seminal vesicles and bulbourethral glands.

(a) Prostate glands → It surrounds the urethra and produces a milky secretions which forms a considerable part of the semen. This secretion consists of citric acid, lipids and enzymes. Secretion of prostate gland nourishes and activate spermatozoa to swim.

(b) Seminal vesicles → These secrete mucus and a watery alkaline fluid that contains fructose which provides energy to sperms.

(c) Bulbourethral glands → These glands are attached to the urethra below the prostate gland. They secrete mucus fluid for the lubrication of the penis.

(iv) External Genitalia

Penis → It is the male copulatory organ.



having erectile tissues and vascular spaces. When the male is sexually excited these spaces filled with blood, causing the penis to erect.

The distal end of the penis is called glans penis. The glans penis is covered with a smooth skin called foreskin.

Female Reproductive System

The female reproductive system consists of the following:-

- (i) Primary Sex Organ :- Ovary
- (ii) Secondary Sex organ :-
 - (a) Accessory ducts :- pair of oviducts (fallopian tubes), uterus, cervix and vagina
 - (b) Accessory glands :- mammary gland
- (iii) External genitalia :- vulva

(i) Ovaries → Ovaries are the primary female sex ~~hormones~~ ^{hormone} organs that produce the female gametes (ovum) and several steroid hormones (ovarian hormones).

Ovaries are located one on each side of the lower abdomen and remain attached to the pelvic wall and uterus

by ovarian ligaments. Each ovary is almond-like flattened body, measuring about 2-4 cm in length.

(a) Oviducts (Fallopian Tubes) → These are two small tubes, about 10-12 cm in length, lying on either sides of the uterus near the kidney. The opening of fallopian tube is expanded into funnel-shaped infundibulum.

The end of infundibulum has finger like projections called fimbriae. The infundibulum leads to the wider part of the oviduct called ampulla. Isthmus is the last part of the oviduct having narrow lumen which joins the uterus.

(b) Uterus (Womb) → It is a single, hollow, muscular, pear-shaped structure supported by ligaments and attached to the pelvic wall. It is present b/w urinary bladder and rectum. The lower part of the uterus is very narrow is called cervix. The cavity of cervix is called cervical canal, which forms birth canal along with vagina.



(ii) Mammary Glands → Human female has a pair of mammary glands that contain glandular tissues and fatty tissues. Each glandular tissue is divided into 15-20 mammary lobes and each lobe consists of a group of alveoli. The alveoli open into mammary tubules. The mammary tubules of each lobe open into small mammary duct. Several mammary ducts join to form a wider mammary ampulla that is connected to lactiferous duct just before the nipple through which milk is released.

(iii) External Genitalia (Vulva) → The ext. genitalia of females are collectively and consists of following parts:-

(a) Mons Pubis → A cushion of fatty tissue covered with skin and pubic hair.

(b) Labia majora → Two folds of fatty tissues which extend down from the mons pubis and surround ^{the} vaginal opening.

(c) Clitoris → A tiny finger-like structure,



which lies at the upper junction of the two labia minora, above the urethral opening.

(d) Hymen → A thin mucous membrane that covers the vaginal opening either partly or entirely.

Gametogenesis → It is the process of gamete formation in the gonads (testis and ovary) in sexually reproducing animals.

The two processes of gametogenesis are:-

(i) Spermatogenesis → The process of formation of spermatozoa (sperms) from diploid spermatogonia is called spermatogenesis.

It includes following phases:-

(a) Multiplication phase → The male germ cells (spermatogonia) present on the inside wall of seminiferous tubules multiply by mitotic division and increase in numbers.

(b) Growth phase → Spermatogonia grow

and increase in size and form primary spermatocytes. Each spermatogonium is diploid and contains 46 chromosomes.

(C) Maturation phase → A primary spermatocyte periodically undergoes meiosis and it completes the first meiotic division leading to the formation of two equal haploid cells called secondary spermatocytes, which have only 23 chromosomes each. The secondary spermatocytes undergo second meiotic division to produce four equal haploid spermatids.

(d) Differentiation phase → The spermatids are transformed into spermatozoa by the process of spermiogenesis. The sperm's head attached to Sertoli cells to draw nourishment and are finally released from seminiferous tubules by the process called spermiation.

Structure of a Sperm (Spermatozoa)

It consists of four parts - head, neck, middle piece and tail - enveloped by a plasma membrane.



- Head → It is the enlarged end of a sperm containing the large haploid nucleus, i.e., condensed chromatin body and is capped by acrosome. The acrosome contains hydrolytic enzymes that help in dissolving membranes of the ovum for fertilisation.
- Neck → It contains proximal centriole which is necessary for the first cleavage division of zygote and the distal centriole that is connected to tail filaments.
- Middle piece → It contains a number of mitochondria that provide energy for the movement of tail that fasciculate sperm, motility, essential for fertilisation.
- Tail → It consists of axial filaments surrounded by plasma membrane. It helps the sperms to swim in a fluid medium.

(ii) Oogenesis → The process of formation of a mature female gamete is called oogenesis. It occurs in the ovaries. It consists of following phases:-



- (a) Multiplication phase → Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary.
- (b) Growth phase → Each primary oocyte then gets surrounded by a layer of granulosa cells. This structure is called the primary follicle.
- (c) Maturation phase → In the first maturation phase, the secondary follicle soon transforms into a tertiary follicle.

Menstrual Cycle

The rhythmic series of changes that occur in the reproductive organs of female primates is called menstrual cycle.

It is repeated at an average interval of about 28/29 days.

It has four phases :-

- Menstrual Phase → The soft tissue of endometrial lining of the uterus

disintegrates causing bleeding. The unfertilised egg and soft tissue are discharged. It lasts for 3-5 days.

- Follicular Phase → The primary follicles in the ovary grow and become a fully mature Graafian follicle. It lasts for about 10-14 days.
- Ovulation Phase → Rapid secretion of LH induces rupture of Graafian follicle, thereby leading to ovulation. It lasts for only about 48 hours.
- Luteal Phase → In this phase the ruptured follicle changes into corpus luteum in the ovary and it begins to secrete the hormone progesterone. It lasts for only 1 day.

Fertilisation

The process of fusion of a sperm (male gamete) with an ovum (female gamete) is called fertilisation.

During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and

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induces changes in membrane that block the entry of additional sperm. Thus, it ensures that only one sperm can fertilise an ovum. Soon the haploid nucleus in the sperm and that of the ovum fuse together to form a diploid zygote.

Implantation

When the blastocyst gets embedded in the endometrium of the uterus, this is called implantation which leads to pregnancy.

Pregnancy and Embryonic Development

An intimate connection is established b/w chorionic villi and uterine tissue and forms a structural and functional unit between the developing embryo and the maternal body called placenta.

Functions of Placenta:-

- (i) Provides nutrients and oxygen to the developing embryo.
- (ii) Remove CO_2 and waste materials



from the embryo.

- (iii) Act as an endocrine tissue and produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, progesterones that are essential to maintain pregnancy.

Parturition

The act of expelling the full term foetus from mother's uterus at the end of the gestation period called parturition. It is induced by a complex neuroendocrine mechanism.

Lactation

Mammary glands of female undergo differentiation and start producing milk at the end of the pregnancy. This is called lactation.

This helps the mother in feeding the newborn.

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