CHAPTER-03
HUMAN REPRODUCTION

Humans are sexually reproducing and viviparous. The reproductive events in humans include formation of gametes, sperms in male and ovum in females, transfer of sperms into female genital tract and fusion of male and female gametes. The reproductive event occurs after puberty.

The Male Reproductive System
The male reproductive system includes a pair of testes, along with accessory ducts, glands and external genitalia.

- The testes are situated outside the abdominal cavity in a pouch called scrotum, which help in maintaining the low temperature of testes necessary for spermatogenesis.
- Each testes has about 250 testicular lobules and each lobule contain highly coiled seminiferous tubules in which sperms are produced. Each seminiferous tubules is lined by two types of cells, spermatogonia (male germ cell) and Sertoli cells.
- Leydig cells present around the seminiferous tubules synthesize and secrete androgen hormone.
- Ejaculatory duct store and transport the sperm from testes to outside through urethra which originate from urinary bladder and extend through penis to its external opening urethral meatus.
- The penis is male external genitalia. The enlarged end of penis is called the glans penis is covered by a loose fold of skin called foreskin.
- Male accessory glands include paired seminal vesicles, prostrate and paired bulbourethral glands. Secretion of these glands forms the seminal plasma which contains fructose, calcium and number enzymes. The secretion of bulbourethral glands also helps in lubrication of the penis.

The Female Reproductive System
Female reproductive system consists of a pair of ovaries, a pair of oviduct, uterus, cervix, vagina and external genitalia located in pelvic region. A pair of mammary gland also supports the process of reproduction.

- Ovaries are primary female sex organ that produce the female gamete and several steroid hormones. Each ovary is covered by thin epithelium which encloses the ovarian stroma, which is divided into a peripheral cortex and an inner medulla.
- Fallopian tube extends from periphery of ovary to the uterus. The part closer to ovary is a funnel shaped structure called infundibulum having finger like projection called fimbriae.
Infundibulum leads to ampulla and join with uterus with isthmus. Uterus is pear shaped structure also called womb.

Uterus open vagina through a narrow cervix. The cavity of cervix (cervical canal) along with vagina forms the **birth canal**.

The wall of uterus has three layers of tissue

I. Perimetrium- external membrane.

II. Myometrium – middle thick layer of smooth muscles which exhibit strong contraction during delivery of baby.

III. Endometrium - line the uterine wall and undergo cyclic changes during menstrual cycle.

Female external genitalia includes

- Mons pubis – cushion of fatty tissues covered by skin and pubic hair.
- Labia majora- fleshy fold that surround the vaginal opening.
- Labia manora – paired fold of tissue under labia majora.

The opening of vagina is often partially covered by a membrane called **hymen**. The tiny finger like projection present at the upper junction of two labia manora above the urethral opening is called **clitoris**.

Mammary glands are paired structures that contain glandular tissues and variable fats. Each glandular tissue contains 15-20 mammary lobes containing alveoli that secrete milk. Mammary ducts join to form mammary ampulla.

**Gametogenesis**

The process of formation of male and female gametes in testes and ovary respectively is called gametogenesis.

**Spermatogenesis**- in testes immature, male germ cells (spermatogonia) produce sperm by spermatogenesis that begin at puberty.

- The spermatogonia present at the inner side of seminiferous tubules multiply by mitotic division and increase in number. Each spermatogonium contain 46 chromosomes.
- Spermatogonia forms spermatocyte that undergo meiotic division to reproduce secondary spermatocytes having 23 chromosomes.
- The spermatids are transformed into spermatozoa by the process called spermigenesis. The sperm heads remain embedded in sertoli cells and are released from seminiferous tubules by the process of spermiation.

**Structure of sperm**- sperm is a microscopic structure composed of a head, neck, a middle piece and a tail. The sperm head contain elongated haploid nucleus, anterior portion of which is covered by cap like structure **acrosome**.
• Human male ejaculates about 200-300 million sperms during a coitus. The seminal plasma along with the sperms constitutes the semen. The function of male sex secondary ducts and glands are maintained by androgen hormones.

Oogenesis
The process of formation of mature female gametes is called oogenesis. It started during embryonic development stage when millions of ogonia (gamete mother cells) are formed in each fetal ovary.

➢ The gametes mother cells start division and enter into prophase-I of meiotic division and get temporally arrested at that stage called primary oocytes.
➢ Each primary oocyte get surrounded by a layer of granulosa cell than it is called the primary follicle.
➢ At puberty, about 60,000- 80,000 primary follicles are left in each ovary.

➢ Primary follicle gets surrounded by more layers of granulosa cells called secondary follicle that transform into tertiary follicle that contain fluid filled cavity called antrum.

➢ The tertiary follicles further changes into the mature follicle called Graafian follicle, which rapture to release secondary oocytes (ovum) from the ovary by the process of ovulation.

Menstrual cycle
The reproductive cycles in female primates is called menstrual cycle. It start at puberty and is called menarche. The cycle of events starting from one menstruation till the next one is called the menstrual cycle. One ovum is released (ovulation) at the middle of this cycle.

➢ The cycle starts with menstrual phase, in which menstrual flow occurs for 3-5days due to breakdown of endometrial lining of the uterus.
➢ The pituitary and ovarian hormones brings about changes in ovary and uterus. The LH and FSH hormone causes rapture of Graafian follicle to cause ovulation.
➢ In human females menstrual cycle seized at around 50 years of age that is called menopause.
Fertilisation and Implantation
The process of fusion of sperm with ovum is called fertilisation.

• During coitus (copulation) semen is released into vagina. The motile sperms swim rapidly to reach the junction of isthmus and ampulla of fallopian tube. The ovum also reaches there and fusion of gametes takes place in at ampullary-isthmic junction.

• During fertilisation, a sperm come in contact of zona pellucida layer of ovum to change the membrane to prevent entry of other sperms.

• The haploid gametes fuse together to form diploid zygote. As the zygote moves towards the uterus, the mitotic division starts and form cleavage to change into 2, 4,8,16 celled blastomeres.

• The blastomeres with 8 to 16 cells are called merula. Merula divide to change into blastocysts. The outer layer of blastocyst is called trophoblast that attach with endometrium of uterus, called implantation that leads to pregnancy.

Pregnancy and embryonic development
The finger-like projections on trophoblaste after implantation called is called chronic villi that along with uterine wall forms functional unit between developing embryo and maternal body called placenta. Placenta is attached with fetus with an umbilical cord that transport food and oxygen to embryo.

• Hormones hCG (human chorionic gonadotropin), hPL (human placental lactogen) and relaxin are produced in woman only during pregnancy by placenta.

• The inner cell mass (embryo) contain certain cells called stem cells that have potency to give rise all tissues and organs.

• In human, after one month of pregnancy the embryo’s heart is formed. By the end of 2nd month limbs and digits are formed. By the end of 12 months, major organs and external genital organs are well developed. The first movement of foetus is observed in 5 months. By the end of 24 weeks body is covered with fine hair, eye lids and eyeless are formed. At the end of 9 months fetus is fully developed.

Parturition- the process of delivery of fully developed foetus is called parturition. It occurs due to foetal ejection reflex.

The mammary glands of female, start producing milk, to the end of pregnancy by the process of lactation. The milk produced during the initial few days of lactation is called colostrum, which contain several antibodies.