

BIOLOGY

SHORT STUDY NOTES

**HUMAN
REPRODUCTION**

CLASS 12

BY LEARNINGMANTRAS.COM

Human Reproduction

Reproduction is an essential process for the survival of a species. The functions of the reproductive systems are to produce reproductive cells, the gametes, and to prepare the gametes for fertilization. In addition, the male reproductive system delivers the gametes to the female reproductive tract. The female reproductive organs nourish the fertilized egg cell and provide an environment for its development into an embryo, a fetus, and a baby.

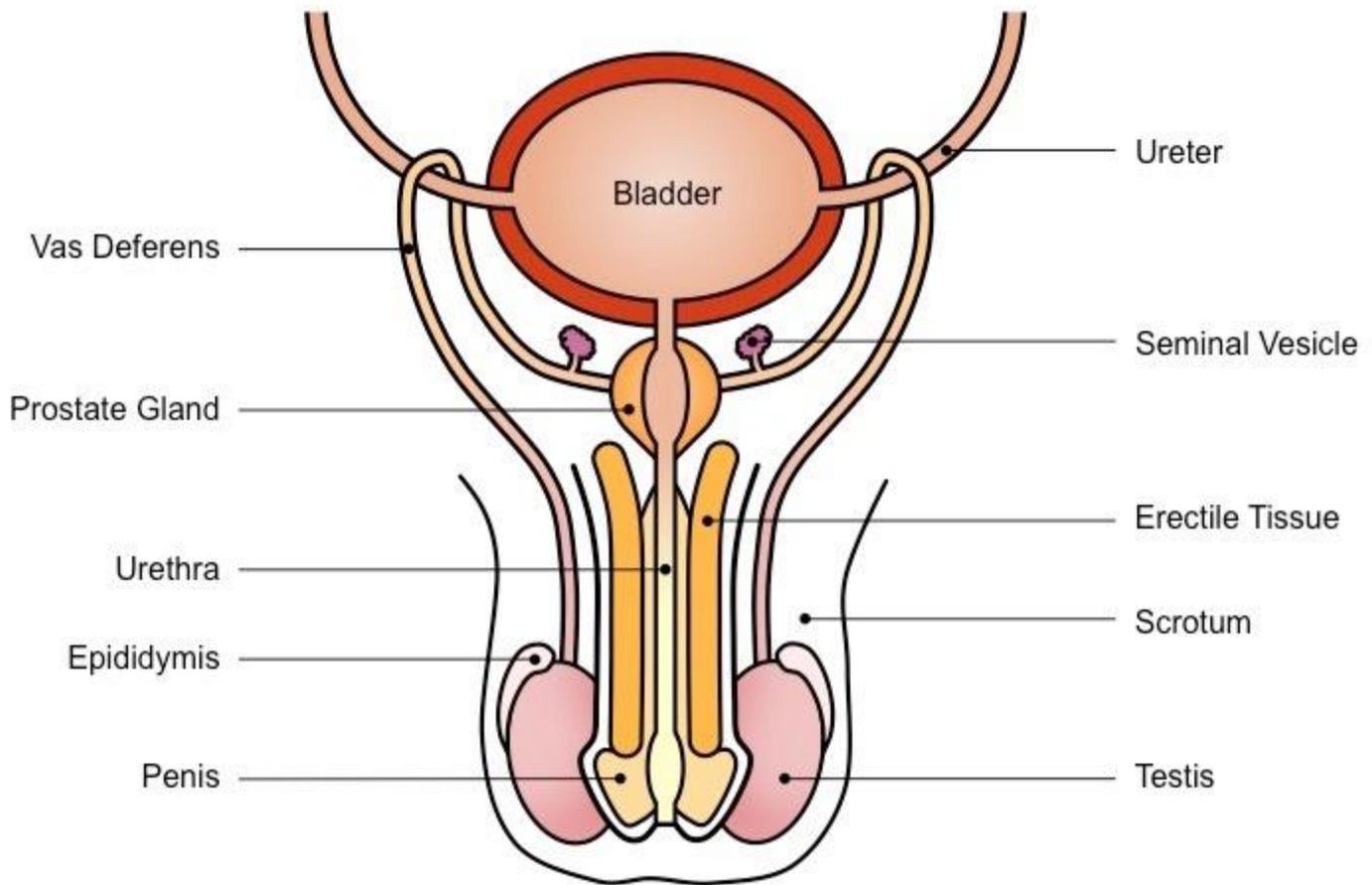
Human reproduction takes place by the coordination of the male and female reproductive systems. In humans, both males and females have evolved specialized organs and tissues that produce haploid cells, the sperm and the egg. These cells fuse to form a zygote that eventually develops into a growing fetus. A hormonal network is secreted that controls both the male and female reproductive systems and assists in the growth and development of the fetus and the birthing process.

Male Reproductive System

Male reproductive system is located in the pelvis region. It consists of – a pair of testis, glands, accessory ducts, external genitalia. The male reproductive system is responsible for sexual function, as well as urination.

The entire male reproductive system is dependent on hormones. These are chemicals that stimulate or regulate the activity of your cells or organs. The primary hormones involved in the functioning of the male reproductive system are follicle-stimulating hormone (FSH), luteinizing hormone (LH) and testosterone.

- The male reproductive system is positioned in the pelvis region and comprises a pair of testes in addition to the accessory glands, ducts, and the external genitalia.
- A pouch-like structure known as scrotum encloses the testes located outside the abdominal cavity.
- Each testis has close to 250 testicular lobules (compartments). These lobules comprise 1-3 seminiferous tubules wherein the sperms are produced. The lining of these tubules consists of two types of cells – male germ cells and Sertoli cells.
- The exterior of these tubules consists of spaces containing blood vessels and Leydig cells.
- Male sex accessory ducts comprise rete testis, vasa efferentia, epididymis and vas deferens.
- The urethra opens externally to the urethral meatus.
- The male external genitalia, the penis is covered by foreskin which is a loose fold of skin.



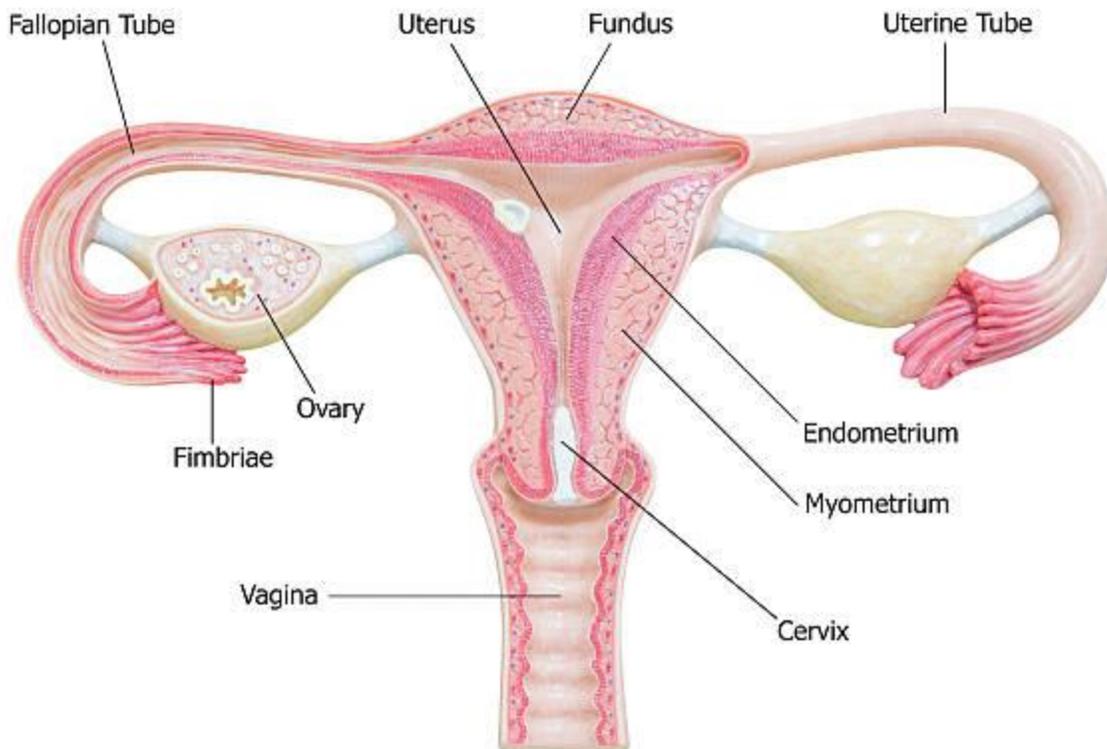
Parts of Male Reproductive System

- **Penis:** Penis are the organ used for urination and sexual intercourse. It has spongy tissue which can fill with blood to cause an erection. It contains the urethra, which carries both urine and semen.
- **Scrotum:** Scrotum is a loose bag of skin that hangs outside the body, behind the penis. It holds the testes in place.
- **Testes (or testicles):** Testes are a pair of egg-shaped glands that sit in the scrotum, on the outside of the body. They produce sperm and testosterone, which is the male sex hormone.
- **Epididymis:** Epididymis is a highly coiled tube that lies at the back of the testes. All sperm from the testes must pass through the epididymis, where they mature and start to 'swim'.
- **Vas deferens:** Epididymis is a thick-walled tube joined to the epididymis. It carries sperm from the epididymis up to the prostate gland and urethra.
- **Prostate gland:** Prostate gland is a walnut-sized gland that sits in the middle of the pelvis. The urethra runs through the middle of it. It produces the fluid secretions that support and nourish the sperm.
- **Urethra:** Urethra is a tube that extends from the bladder to the external opening at the end of the penis. The urethra carries both urine and sperm.
- **Seminal vesicles:** Seminal vesicles are 2 small glands above the prostate gland that make up much of the fluid in semen.

Female Reproductive System

The female reproductive system is involved in sexual activity and fertility, and includes organs such as the uterus (womb), ovaries, fallopian tubes and vagina, as well as hormones. During menopause, the female reproductive system gradually stops making the female hormones necessary for the reproductive cycle to work. At this point, menstrual cycles can become irregular and eventually stop. One year after menstrual cycles stop, the woman is considered to be menopausal.

- The female accessory ducts are constituted by the oviducts, vagina and uterus.
- The section closer to the ovary is funnel-shaped infundibulum that possesses the fimbriae – finger-like projections facilitating the assimilation of ovum post ovulation.
- The infundibulum directs to a wider section of oviduct known as ampulla.
- The last section of the oviduct, isthmus, has a narrow lumen joining the uterus.
- Uterus is also known as the womb.
- The cervical cavity is known as the cervical canal which goes onto form the birth canal along with the vagina.
- Female external genitalia comprises – mons pubis, labia minora, labia majora, clitoris and hymen.



Parts of Female Reproductive System

- **Vagina:** The vagina is a canal that joins the cervix (the lower part of the uterus) to the outside of the body. It also is known as the birth canal.
- **Uterus (womb):** The uterus is a hollow, pear-shaped organ that is the home to a developing fetus. The uterus is divided into two parts: the cervix, which is the lower part that opens into the vagina, and the main body of the uterus, called the corpus. The corpus can easily expand to hold a developing baby. A canal through the cervix allows sperm to enter and menstrual blood to exit.
- **Ovaries:** The ovaries are small, oval-shaped glands that are located on either side of the uterus. The ovaries produce eggs and hormones.
- **Fallopian tubes:** These are narrow tubes that are attached to the upper part of the uterus and serve as pathways for the ova (egg cells) to travel from the ovaries to the uterus. Fertilization of an egg by a sperm normally occurs in the fallopian tubes. The fertilized egg then moves to the uterus, where it implants to the uterine lining.

Anatomy of Testes

In humans each testis weighs about 25 grams (0.875 ounce) and is 4–5 cm (1.6–2.0 inches) long and 2–3 cm (0.8–1.2 inches) in diameter. Each is covered by a fibrous capsule called the tunica albuginea and is divided by partitions of fibrous tissue from the tunica albuginea into 200 to 400 wedge-shaped sections, or lobes. Within each lobe are 3 to 10 coiled tubules, called seminiferous tubules, which produce the sperm cells. The partitions between the lobes and the seminiferous tubules both converge in one area near the anal side of each testis to form what is called the mediastinum testis.

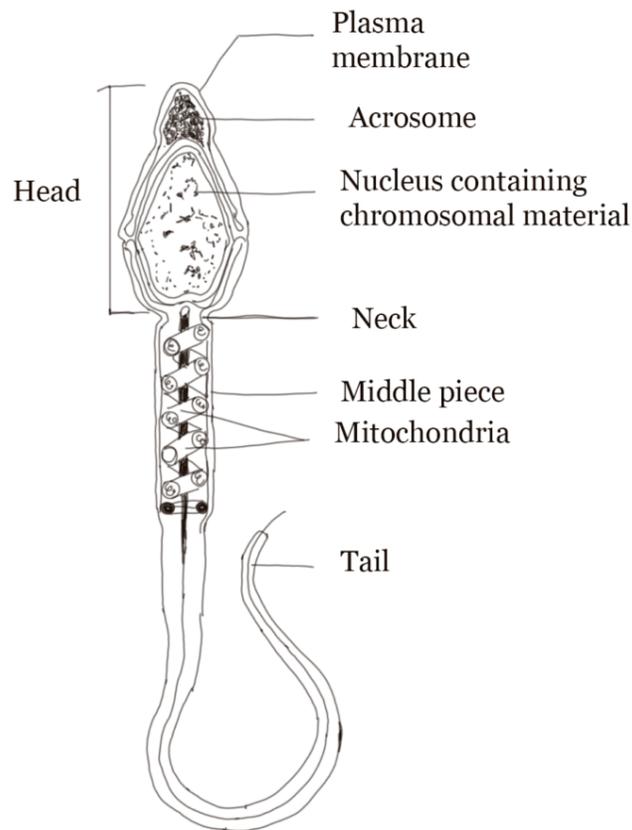
Anatomy of Ovary

The ovaries are the female pelvic reproductive organs that house the ova and are also responsible for the production of sex hormones. They are paired organs located on either side of the uterus within the broad ligament below the uterine (fallopian) tubes. The ovary is within the ovarian fossa, a space that is bound by the external iliac vessels, obliterated umbilical artery, and the ureter. The ovaries are responsible for housing and releasing ova, or eggs, necessary for reproduction. At birth, a female has approximately 1-2 million eggs, but only 300 of these eggs will ever become mature and be released for the purpose of fertilization.

Structure of a Sperm

- It is a microscopic, motile structure composed of a head, neck, a middle piece and a tail.
- Whole body is covered by plasma membranes.
- The sperm head contains an elongated haploid nucleus and the anterior portion is covered by a cap-like structure.
- The middle piece contains numerous mitochondria which produce energy for sperm motility needed for fertilization.
- Tail helps the sperm cell to swim to reach the egg cell.

- Seminal plasma along with sperm constitutes the semen.



Structure of sperm

Gametogenesis

The process of formation of gametes in primary sex organs is called Gametogenesis. Gametogenesis includes:

- Spermatogenesis and spermiogenesis in males.
- Oogenesis in females.

Spermatogenesis: The process of formation of sperms is called spermatogenesis. It involves 3 phases- multiplication phase, growth phase, maturation phase. In the growth phase, spermatogonia increase their size by accumulation of nutrition in the cytoplasm and are ready for meiotic division and the spermatocytes are called primary spermatocytes with 46 chromosomes. The spermatids are transformed into sperms, also called spermatozoa by the process called spermiogenesis.

Oogenesis: Oogenesis is the type of gametogenesis through which ova, also called the female gametes, are formed and the produced female gamete is known as an ovum. In general terms, the female gametes are referred to as eggs, but the word egg can involve various stages of development, therefore, the significance of an egg varies based on the type of organisms.

Menstrual Cycle

The menstrual cycle is complex and is controlled by many different glands and the hormones that these glands produce. A brain structure called the hypothalamus causes the nearby pituitary gland to produce certain chemicals, which prompt the ovaries to produce the sex hormones oestrogen and progesterone. The average length of the menstrual cycle is 28–29 days, but this can vary between women and from one cycle to the next. The length of your menstrual cycle is calculated from the first day of your period to the day before your next period starts.

How does the menstrual cycle work?

Females of reproductive age (beginning anywhere from 11 to 16 years of age) experience cycles of hormonal activity that repeat at about one-month intervals. The average menstrual cycle takes about 28 days and occurs in phases. These phases include:

- Menstrual phase (first stage of the menstrual cycle)
- Follicular phase (development of the egg)
- Ovulatory phase (release of the egg)
- Luteal phase (hormone levels decrease if the egg does not implant)

Fertilization

The fusion of haploid male gamete, sperm and haploid female gamete, ovum is called fertilization. During sexual intercourse, some sperm ejaculated from the male penis swim up through the female vagina and uterus toward an oocyte (egg cell) floating in one of the uterine tubes. The sperm and the egg are gametes. They each contain half the genetic information necessary for reproduction.

When a sperm cell penetrates and fertilizes an egg, that genetic information combines. The 23 chromosomes from the sperm pair with 23 chromosomes in the egg, forming a 46-chromosome cell called a zygote. The zygote starts to divide and multiply. As it travels toward the uterus it divides to become a blastocyst, which will burrow into the uterine wall.

Sex Determination in Humans

- Male has two sex chromosomes X and Y hence male produces 50% of sperms carrying X and 50% carrying Y, while female has two X chromosomes.
- After fusion of the male and female gametes the zygote would carry either XX or XY depending on whether the sperm carrying X or Y fertilized the ovum.
- The zygote carrying XX would develop into a female baby and XY would form a male.

Cleavage

- Cleavage is the mitotic division which starts as the zygote moves through the isthmus of the oviduct towards the uterus and forms 2, 4, 8, 16 daughter cells called as **blastomeres**
- The embryo with 8 to 16 blastomeres is called a **morula**

- The morula divides further as it moves further in to the uterus and transforms into **blastocyst**
- The blastomeres in the blastocyst are arranged into an outer layer called **trophoblast** and inner mass of cells attached to trophoblast is called **inner cell mass**.
- The trophoblast layer then gets attached to the endometrium of the uterus and the inner cell mass divides to cover the blastocyst hence blastocyst becomes embedded in the endometrium of the uterus and the process is called implantation.

Pregnancy and Embryonic Development

After implantation, finger-like projections appear on the trophoblast called as chorionic villi. Uterine tissue and maternal blood surrounds the chorionic villi. The chorionic villi and uterine tissue together form a structural and functional organic structure between developing embryo and tissues of the mother called as placenta.

Parturition

When the process of gestation is completed by the embryo which is about 280 days it's time for the process of birth of the baby. At the time of birth there are powerful contractions of the muscles of the uterus and the baby arrives with the head first out. After the birth of the infant the blood vessels in the umbilical cord shrink. They are tied in a knot and cut. After a while, the placenta breaks from the uterus and is expelled out. The uterus regains its normal shape after some days.

Lactation

Production of milk in the mammary gland is called lactation. Secretion and storage of milk is carried out under the influence of prolactin. Ejection of milk is stimulated by oxytocin. The first milk which comes from the mammary glands of the mother just after the child birth is called colostrum. The main constituents of human milk are fat, caesin, lactose, mineral salts and vitamins.

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