

**NORTH POINT SENIOR SECONDARY BOARDING SCHOOL
ARJUNPUR**

CLASS – XII- SCIENCE

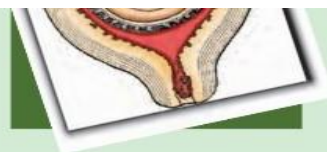
SUBJECT – HUMAN

REPRODUCTION

TEACHER – PARAMITA PAL

CHAPTER 3

HUMAN REPRODUCTION



- 3.1 *The Male Reproductive System*
- 3.2 *The Female Reproductive System*
- 3.3 *Gametogenesis*
- 3.4 *Menstrual Cycle*
- 3.5 *Fertilisation and Implantation*
- 3.6 *Pregnancy and Embryonic Development*
- 3.7 *Parturition and Lactation*

As you are aware, humans are sexually reproducing and viviparous. The reproductive events in humans include formation of gametes (gametogenesis), i.e., sperms in males and ovum in females, transfer of sperms into the female genital tract (insemination) and fusion of male and female gametes (fertilisation) leading to formation of zygote. This is followed by formation and development of blastocyst and its attachment to the uterine wall (implantation), embryonic development (gestation) and delivery of the baby (parturition). You have learnt that these reproductive events occur after puberty. There are remarkable differences between the reproductive events in the male and in the female, for example, sperm formation continues even in old men, but formation of ovum ceases in women around the age of fifty years. Let us examine the male and female reproductive systems in human.

3.1 THE MALE REPRODUCTIVE SYSTEM

The male reproductive system is located in the pelvis region (Figure 3.1a). It includes a pair of **testes** along with **accessory ducts**, **glands** and the **external genitalia**.



The testes are situated outside the abdominal cavity within a pouch called **scrotum**. The scrotum helps in maintaining the low temperature of the testes ($2-2.5^{\circ}\text{C}$ lower than the normal internal body temperature) necessary for spermatogenesis. In adults, each testis is oval in shape, with a length of about 4 to 5 cm and a width of about 2 to 3 cm. The testis is covered by a dense covering. Each testis has about 250 compartments called **testicular lobules** (Figure 3.1b).

Each lobule contains one to three highly coiled **seminiferous tubules** in which sperms are produced. Each seminiferous tubule is lined on its inside by two types of cells called **male germ cells** (*spermatogonia*) and **Sertoli cells** (Figure 3.2). The male germ cells undergo meiotic divisions finally leading to sperm formation, while Sertoli cells provide nutrition to the germ cells. The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and **interstitial cells** or **Leydig cells** (Figure 3.2). Leydig cells synthesise and secrete testicular hormones called androgens. Other immunologically competent cells are also present.

The male sex accessory ducts include **rete testis**, **vasa efferentia**, **epididymis** and **vas deferens** (Figure 3.1b). The seminiferous tubules of the testis open into the vasa efferentia through rete testis. The vasa efferentia leave the testis and open into epididymis located along the posterior surface of each testis. The epididymis leads to vas deferens that ascends to the abdomen and loops over the urinary bladder. It receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct (Figure 3.1a). These ducts store and transport the sperms from the testis to the outside through urethra. The urethra originates from the urinary bladder and extends through the penis to its external opening called **urethral meatus**.

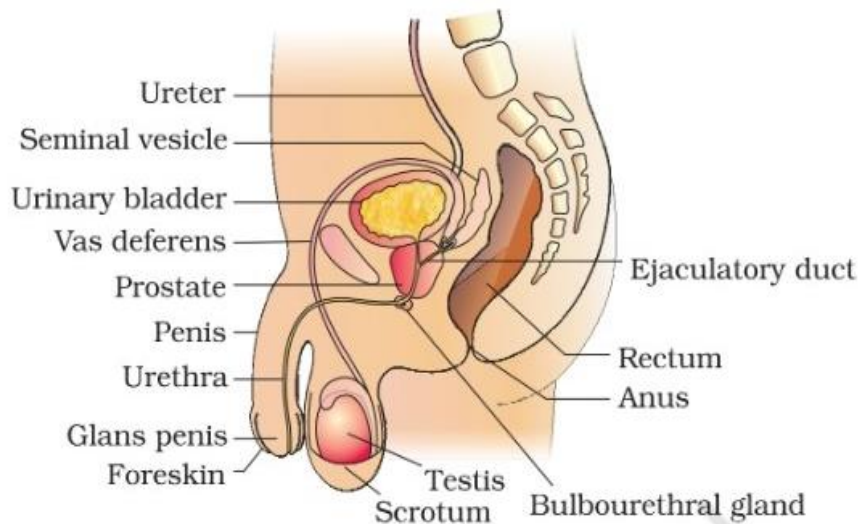


Figure 3.1(a) Diagrammatic sectional view of male pelvis showing reproductive system

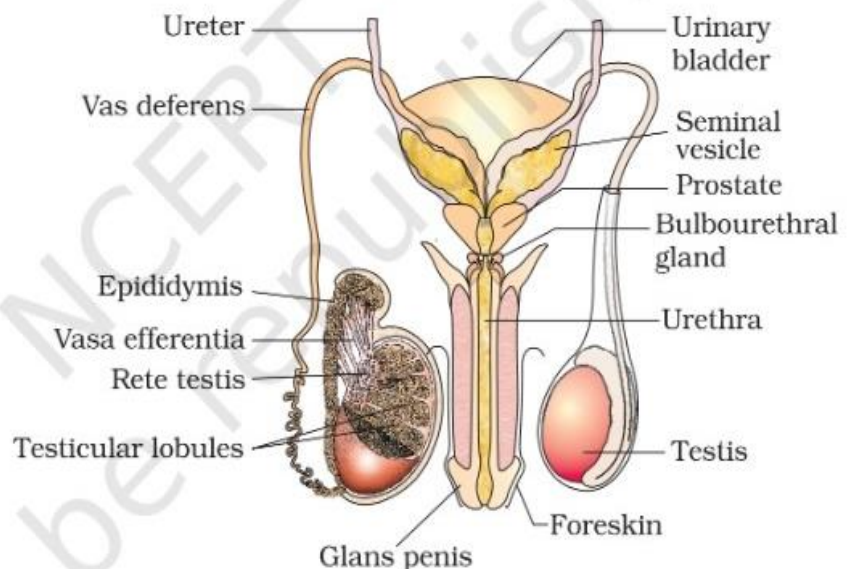
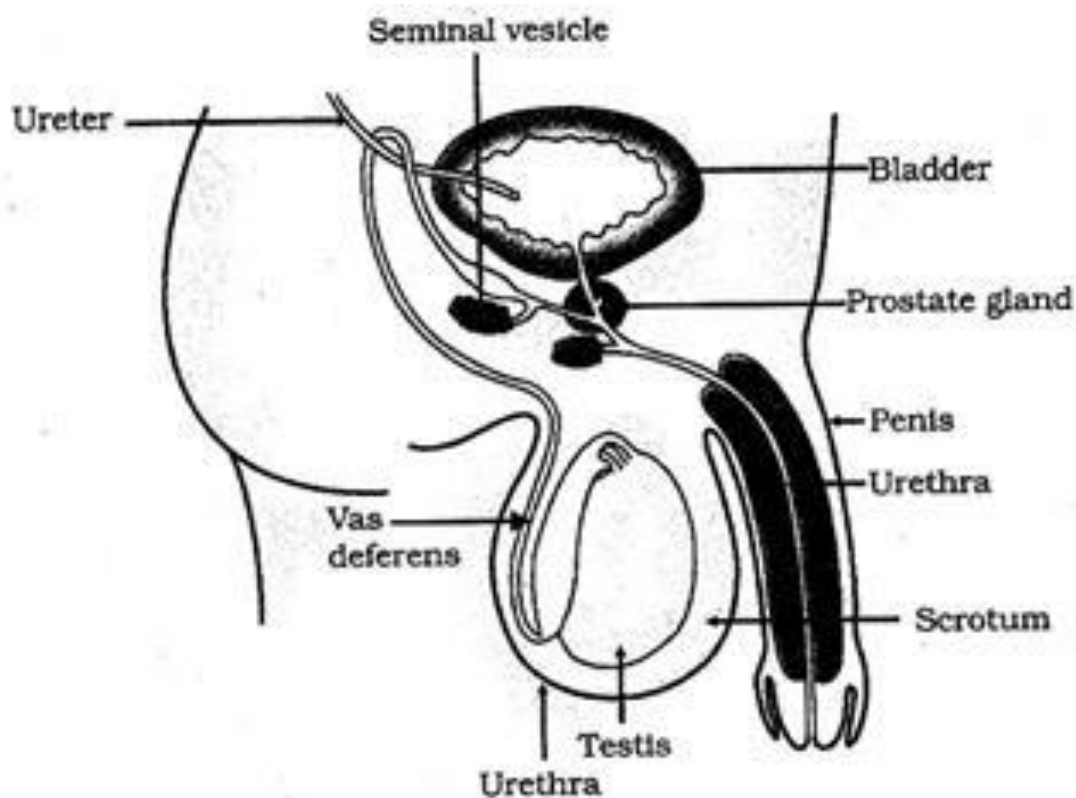
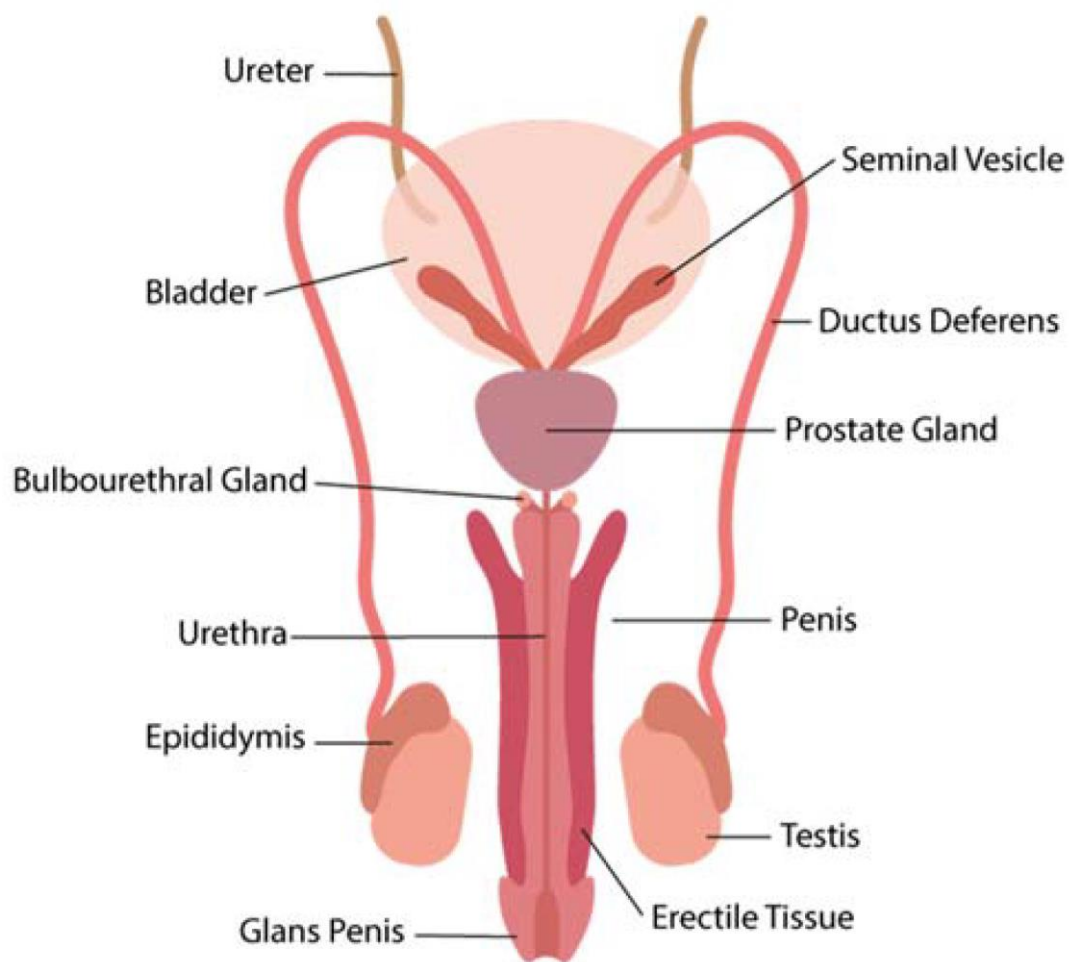


Figure 3.1(b) Diagrammatic view of male reproductive system (part of testis is open to show inner details)



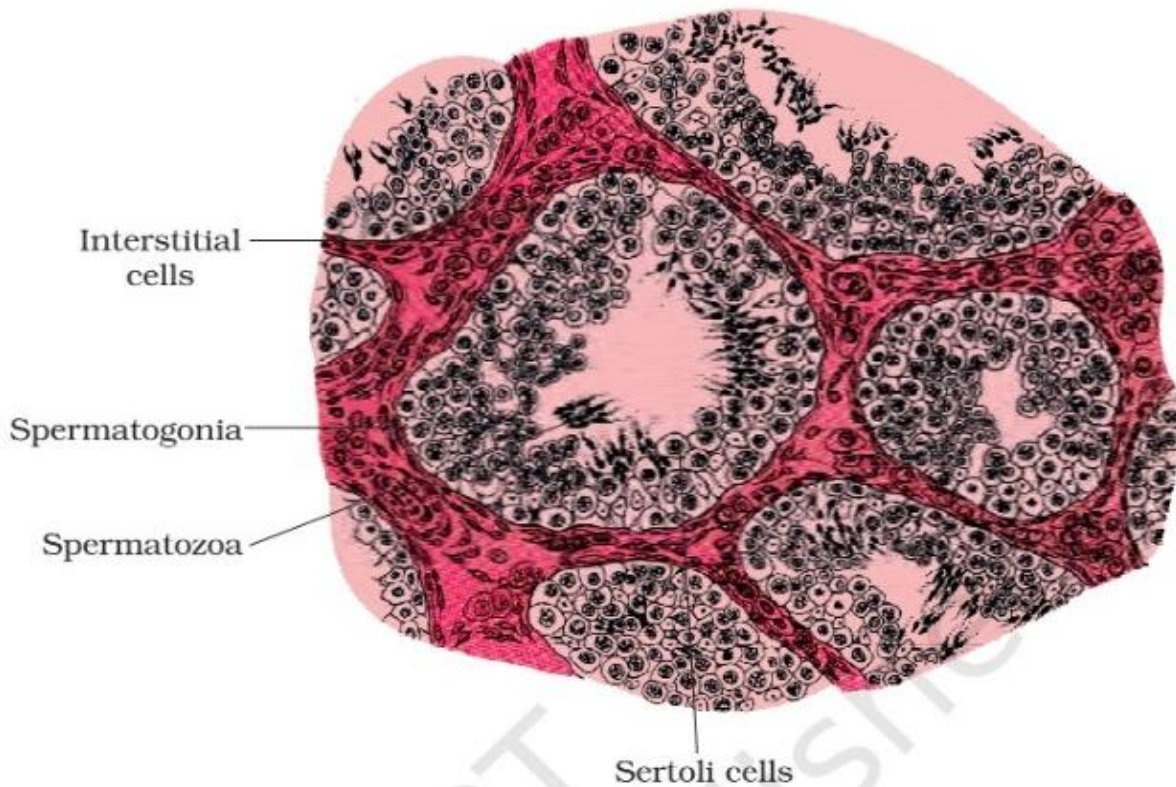


Figure 3.2 Diagrammatic sectional view of seminiferous tubule

The penis is the male external genitalia (Figure 3.1a, b). It is made up of special tissue that helps in erection of the penis to facilitate insemination. The enlarged end of penis called the glans penis is covered by a loose fold of skin called **foreskin**.

The male accessory glands (Figure 3.1a, b) include paired **seminal vesicles**, a **prostate** and paired **bulbourethral** glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes. The secretions of bulbourethral glands also helps in the lubrication of the penis.

3.2 THE FEMALE REPRODUCTIVE SYSTEM

The female reproductive system consists of a pair of **ovaries** along with a pair of **oviducts**, **uterus**, **cervix**, **vagina** and the **external genitalia** located in pelvic region (Figure 3.3a). These parts of the system along with a pair of the **mammary glands** are integrated structurally and functionally to support the processes of ovulation, fertilisation, pregnancy, birth and child care.

Ovaries are the primary female sex organs that produce the female gamete (ovum) and several steroid hormones (ovarian hormones). The ovaries are located one on each side of the lower abdomen (Figure 3.3b). Each ovary is about 2 to 4 cm in length and is connected to the pelvic wall and uterus by ligaments. Each ovary is covered by a thin epithelium which encloses the ovarian stroma. The stroma is divided into two zones – a peripheral cortex and an inner medulla.

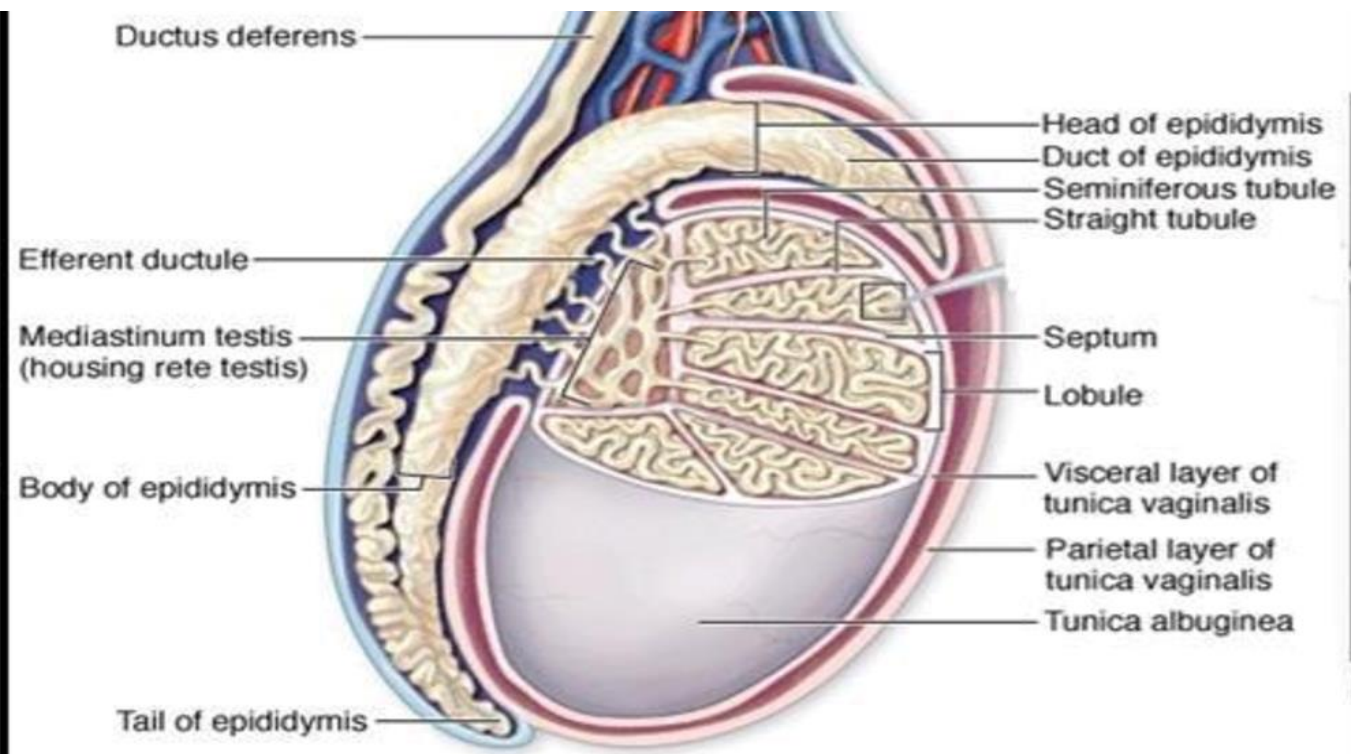
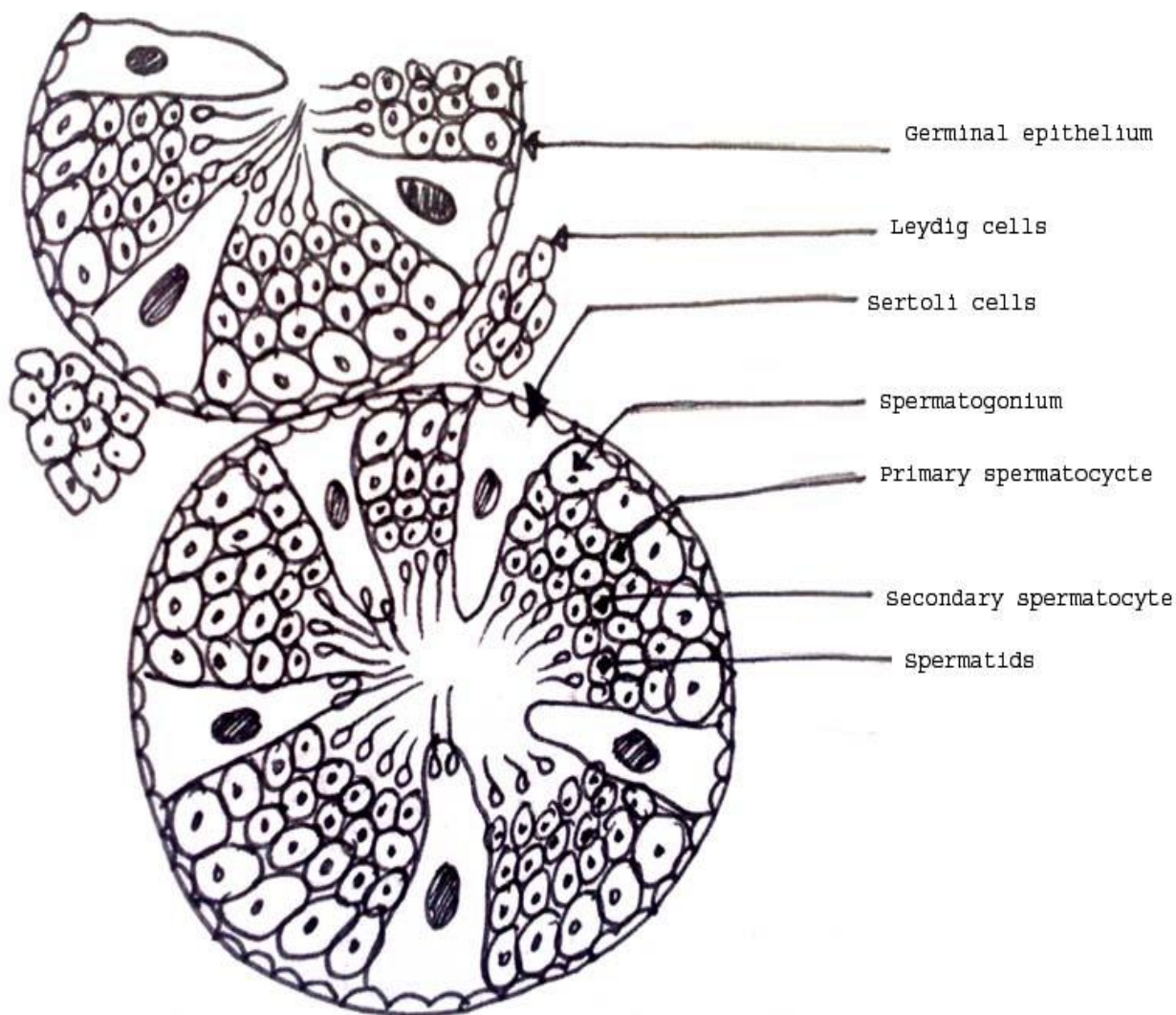


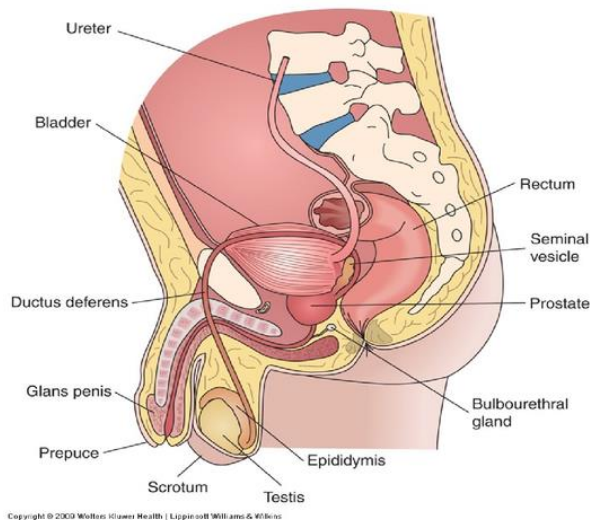
Figure 1: Structure of the testis (Marieb and Hoehn, 2010)



MALE REPRODUCTIVE SYSTEM AT A GLANCE

Male Reproductive System

- Production (spermatogenesis), storage and slivery (seminal fluid / ejaculation) of gamete (sperm). Function in urination
- Testes
 - Androgens; mainly testosterone
 - Spermatozoa (mature in epididymis)
- Internal accessory organs
 - Seminal vesicles, prostate and bulbourethral glands
 - Produce the fluid constituents of semen
 - Ductile system aids in the storage and transport of spermatozoa
- Penis
 - Urine elimination and sexual function



Scrotum

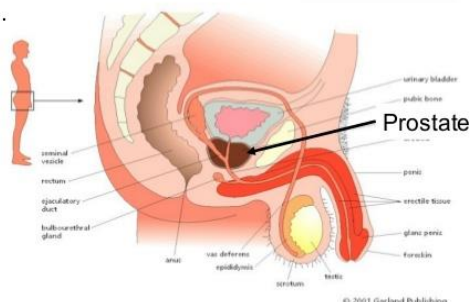
- Sack of skin and superficial fascia
 - Hangs outside abdominopelvic cavity
 - Contains paired testes
 - 3c lower than core body temperature
 - Lower temperature necessary for sperm production
- Temperature kept constant by two sets of muscles
 - Muscles can contract or relax to remove scrotum and testes nearer or further away from the pelvic floor

Testes (Male Gonad)

- Contained within the scrotal sack
- ~250 lobules, each containing 1-4 seminiferous tubules – site of sperm production
- Seminiferous tubules contains:
 - Spermatogenic cells embedded in sertoli cells (secretory cells which nourish the developing sperm. Sperm leaves testes and is stored in epididymis until ejaculation)
- Leydig cells produce male hormones (androgens): e.g. testosterone. Found in interstitial tissues of seminiferous tubules

Prostate gland:

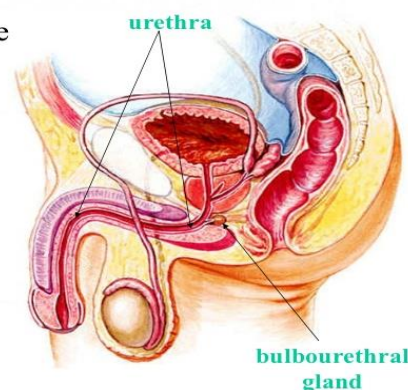
- Location- surrounds and opens into the urethra where it leaves the bladder.
- Secretion- slightly alkaline fluid that activates the sperm and prevents them from sticking together
 - Prostate problems are common in males over 40.
 - Prostate cancer is one of the most common cancers in men.



Bulbourethral gland

(Cowper's gland) – secretes a viscid, alkaline secretion that cleanses urethra and lubricates penis.

Urethra – common tube from bladder and reproductive organs. Carries ejaculate out of the body.





Function of semen

- Transport medium
- Activation of spermatozoal motility
- Provides nutritive substances
- Transport the spermatozoa to the female egg
- Provides enzymes necessary to penetrate the ovum wall & achieve fertilization

Function of Seminal Vesicle

The **secretions** of the seminal gland have a key role in the normal functioning of semen, making up 70% of its total volume.

It is notable however that the first fractions of expelled semen contain mainly spermatozoa and prostatic secretions; the fluids from the seminal vesicles are included in the **late ejaculate fractions**. These fluids contain:

Alkaline fluid – neutralises the acidity of the male urethra and vagina in order to facilitate the survival of spermatozoa.

Fructose – provides an energy source for spermatozoa.

Prostaglandins – have a role in suppressing the female immune response to foreign semen.

Clotting factors – designed to keep semen in the female reproductive tract post-ejaculation.

The remaining volume of semen is made up of testicular spermatozoa, prostatic secretions and mucus from the bulbourethral gland.

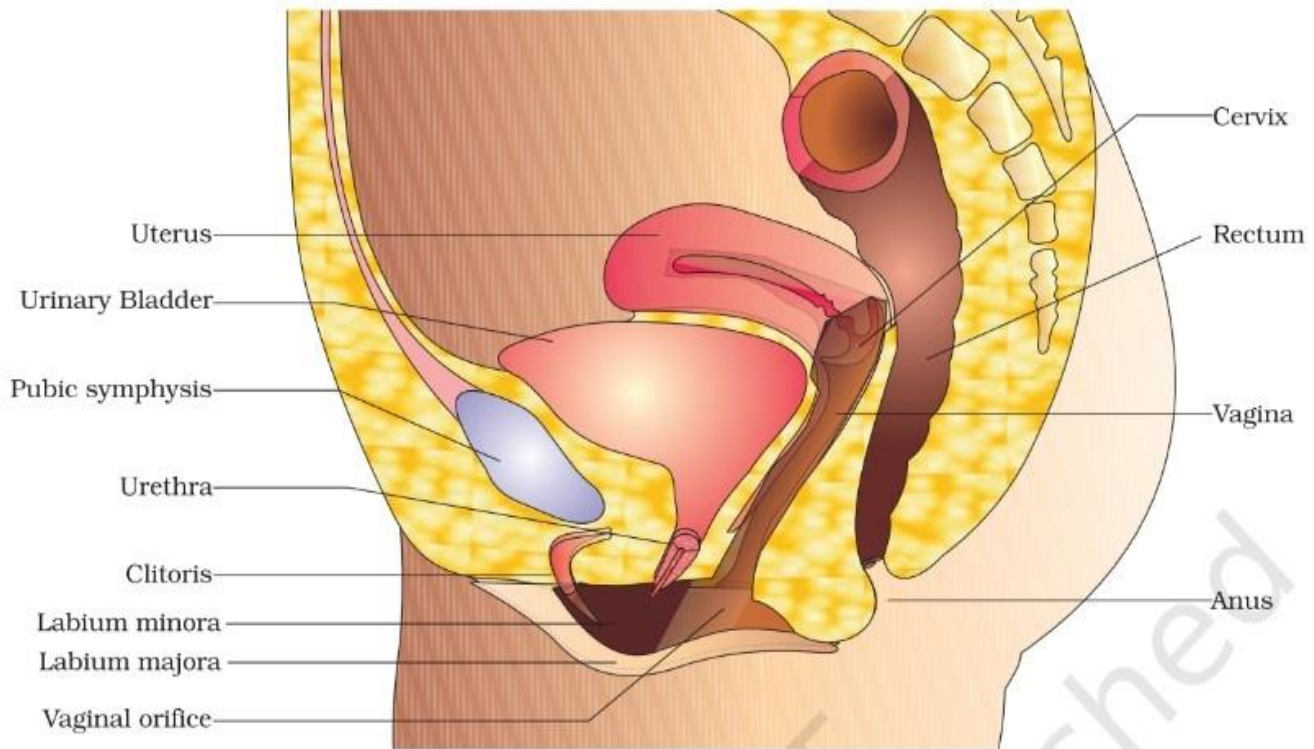


Figure 3.3 (a) Diagrammatic sectional view of female pelvis showing reproductive system

The oviducts (fallopian tubes), uterus and vagina constitute the female accessory ducts. Each fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus (Figure 3.3b), the part closer to the ovary is the funnel-shaped **infundibulum**. The edges of the infundibulum possess finger-like projections called **fimbriae**, which help in collection of the ovum after ovulation. The infundibulum leads to a wider

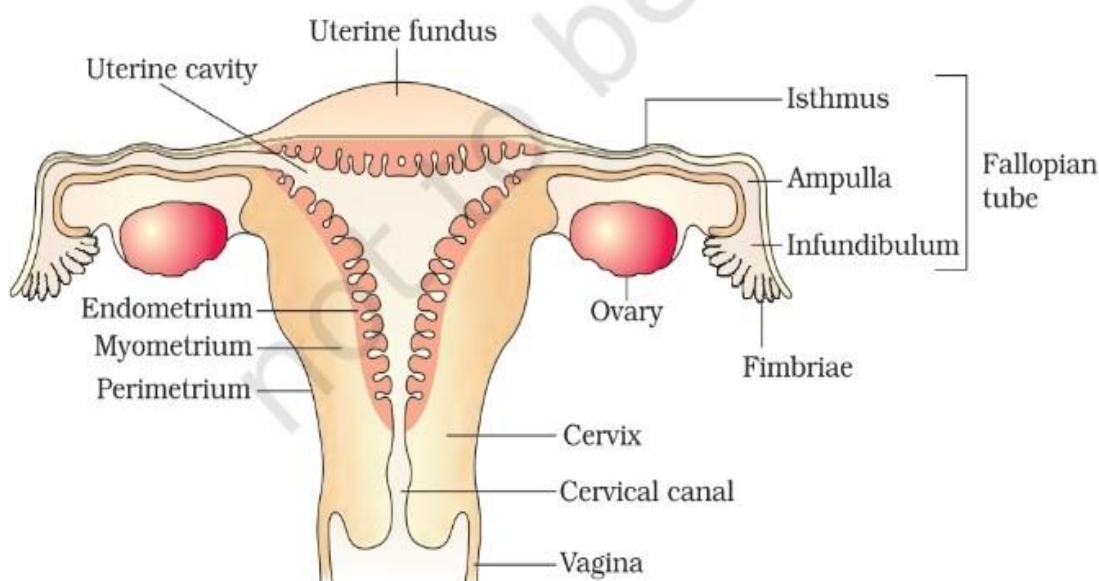
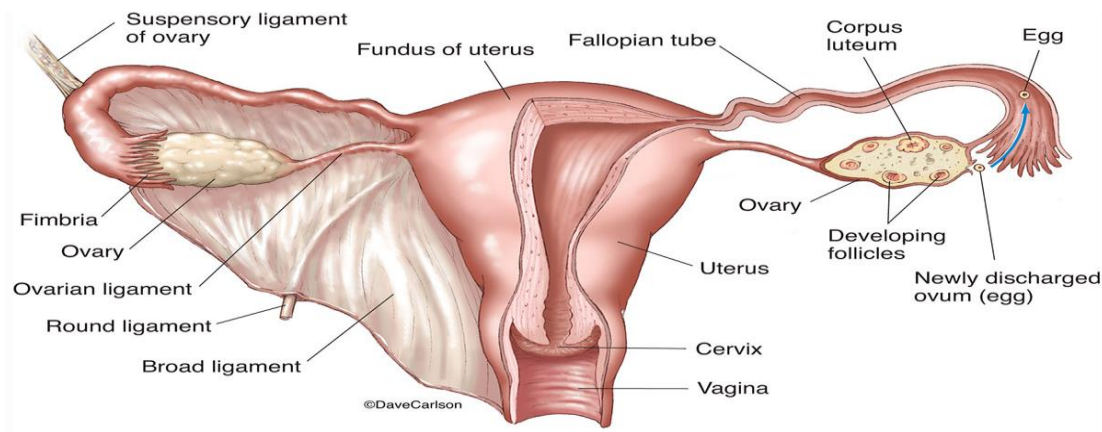
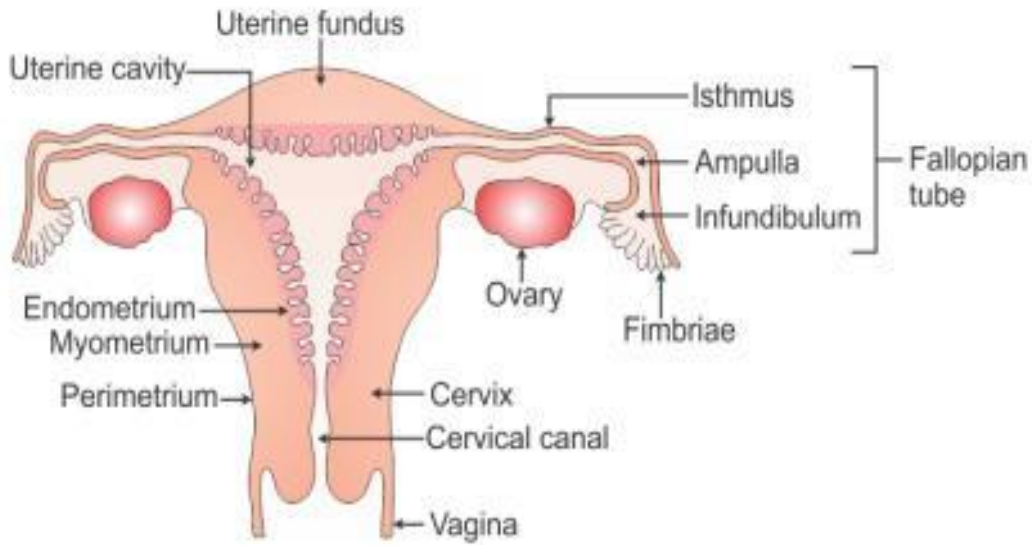
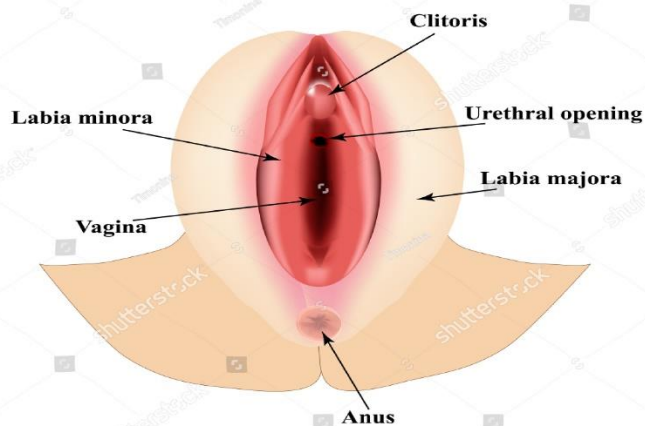


Figure 3.3 (b) Diagrammatic sectional view of the female reproductive system

Female Reproductive System



ANATOMY OF THE FEMALE EXTERNAL GENITALIA



part of the oviduct called **ampulla**. The last part of the oviduct, **isthmus** has a narrow lumen and it joins the uterus.

The uterus is single and it is also called **womb**. The shape of the uterus is like an inverted pear. It is supported by ligaments attached to the pelvic wall. The uterus opens into vagina through a narrow cervix. The cavity of the cervix is called **cervical canal** (Figure 3.3b) which alongwith vagina forms the birth canal. The wall of the uterus has three layers of tissue. The external thin membranous **perimetrium**, middle thick layer of smooth muscle, **myometrium** and inner glandular layer called **endometrium** that lines the uterine cavity. The endometrium undergoes cyclical changes during menstrual cycle while the myometrium exhibits strong contraction during delivery of the baby.

The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris (Figure 3.3a). **Mons pubis** is a cushion of fatty tissue covered by skin and pubic hair. The **labia majora** are fleshy folds of tissue, which extend down from the mons pubis and surround the vaginal opening. The **labia minora** are paired folds of tissue under the labia majora. The opening of the vagina is often covered partially by a membrane called **hymen**. The **clitoris** is a tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening. The hymen is often torn during the first coitus (intercourse). *However, it can also be broken by a sudden fall or jolt, insertion of a vaginal tampon, active participation in some sports like horseback riding, cycling, etc. In some women the hymen persists even after coitus. In fact, the presence or absence of hymen is not a reliable indicator of virginity or sexual experience.*

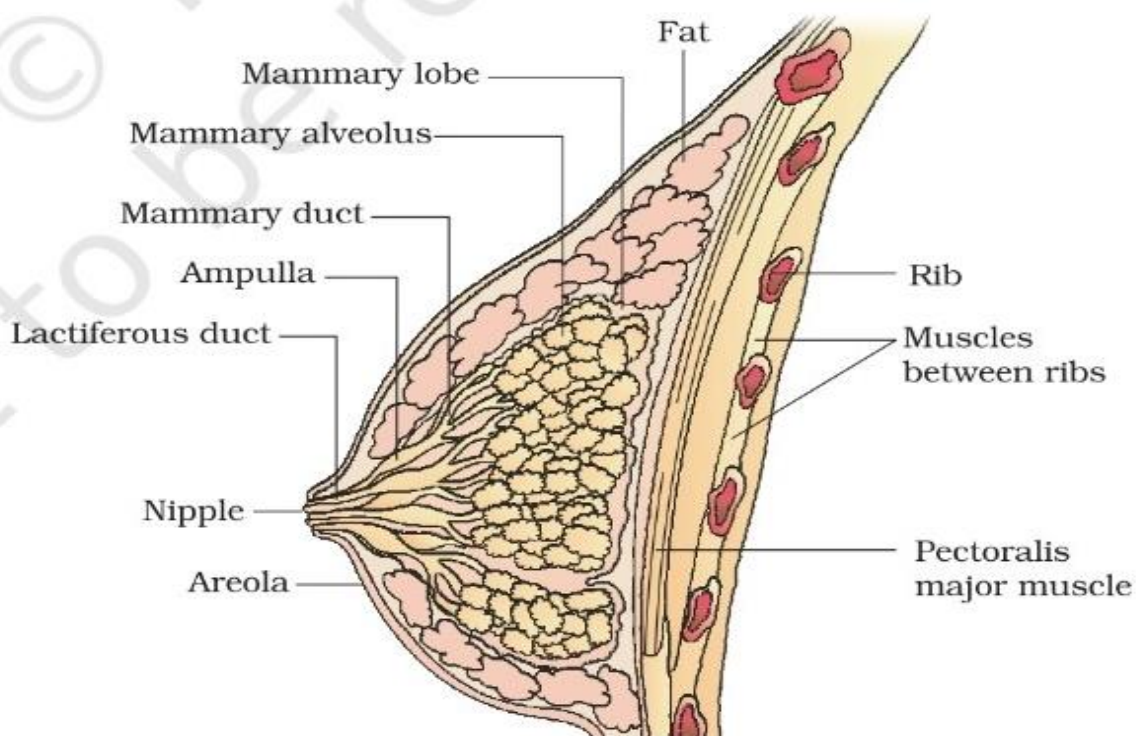


Figure 3.4 A diagrammatic sectional view of Mammary gland