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## Learning Outcome of Module-05

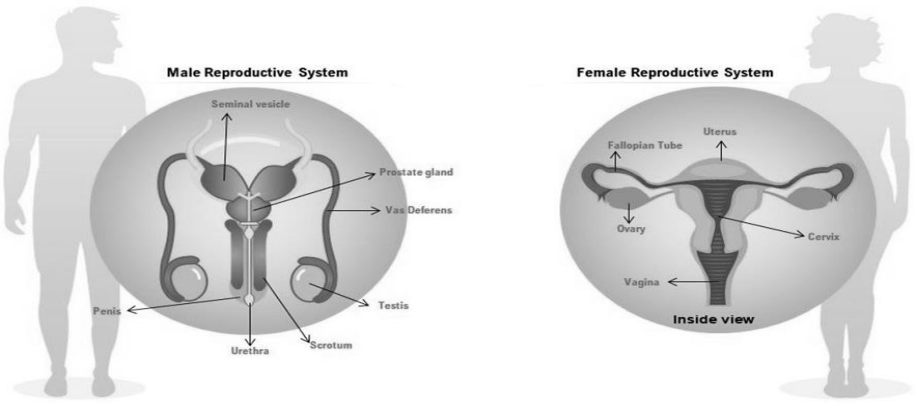
| LO | Learning Outcome | Course Outcome Code |
|---|---|---|
| LO 1 | To understand anatomy and physiology of Female reproductive system. | BP201.6 |
| LO 2 | To understand anatomy and physiology of Male reproductive system. | BP201.6 |
| LO 3 | To understand the phases of menstrual cycle. | BP201.6 |
| LO 4 | To understand physiology of Spermatogenesis ,Oogenesis, Pregnancy and parturition | BP201.6 |

## Content Table

| Topic |
| --- |
| • Anatomy of male and female reproductive system, sex hormones,<br>• Functions of male and female reproductive system<br>• Physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition. |

# REPRODUCTIVE SYSTEM

The ability to reproduce is one of the properties distinguishing living from non-living matter. In mammals, including humans, the process is one of sexual reproduction, in which the male and female organs differ anatomically and physiologically, and the new individual develops from the fusion of two different sex cells (gametes).The male gametes are called spermatozoa and the female gametes are called ova.




*Male and female reproductive system*

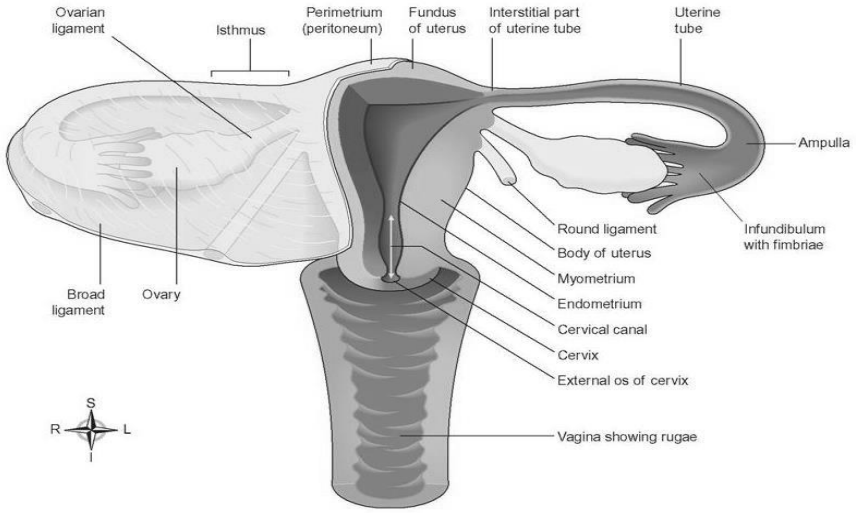
## Female reproductive system

The female reproductive organs, or genitalia, include both external and internal organs

### External genitalia (vulva)

The external genitalia are known collectively as the vulva, and consist of the labia majora and labia minora, the clitoris, the vaginal orifice, the vestibule, the hymen and the vestibular glands (Bartholin's glands).

**Structure of female reproductive system**



## Internal genitalia

The internal organs of the female reproductive system lie in the pelvic cavity and consist of the vagina, uterus, two uterine tubes (fallopian tube) and two ovaries.

## Vagina

The vagina is a fibromuscular tube lined with stratified squamous epithelium opening into the vestibule at its distal end, and with the uterine cervix protruding into its proximal end. It runs obliquely upwards and backwards at an angle of about 45° between the bladder in front and rectum and anus behind. In the adult, the anterior wall is about 7.5 cm long and the posterior wall about 9 cm long. The difference is due to the angle of insertion of the cervix through the anterior wall.

## Structure of the vagina

The vaginal wall has three layers: an outer covering of areolar tissue, a middle layer of smooth muscle and an inner lining of stratified squamous epithelium that forms ridges or rugae. It has no secretory glands but the surface is kept moist by cervical secretions. Between puberty and the menopause, Lactobacillus acidophilus, bacteria that secrete lactic acid, are normally present maintaining the pH between 4.9 and 3.5. The acidity inhibits the growth of most other micro-organisms that may enter the vagina from the perineum or during sexual intercourse.The vagina acts as the receptacle for the penis during sexual intercourse (coitus), and provides an elastic passageway through which the baby passes during childbirth.

## Uterus

The uterus is a hollow muscular pear-shaped organ, flattened anteroposteriorly. It lies in the pelvic cavity between the urinary bladder and the rectum.

In most women, it leans forward (anteversion), and is bent forward (anteflexion) almost at right angles to the vagina, so that its anterior wall rests partly against the bladder below, forming the vesicouterine pouch between the two organs.

When the body is upright, the uterus lies in an almost horizontal position. It is about 7.5 cm long, 5 cm wide and its walls are about 2.5 cm thick. It weighs between 30 and 40 grams. The parts of the uterus are the fundus, body and cervix. **Fundus** is the dome-shaped part of the uterus above the openings of the uterine tubes. **Body** is the main part. It is narrowest inferiorly at the internal os where it is continuous with cervix. **Cervix, ('neck' of the uterus)** protrudes through the anterior wall of the vagina, opening into it at the external os.

## Structure of uterus

The walls of the uterus are composed of three layers of tissue: perimetrium, myometrium and endometrium

**Perimetrium.** This is peritoneum, which is distributed differently on the various surfaces of the uterus.

Anteriorly it lies over the fundus and the body where it is folded on to the upper surface of the urinary bladder. This fold of peritoneum forms the vesicouterine pouch. Posteriorly the peritoneum covers the fundus, the body and the cervix, and then it folds back on to the rectum to form the rectouterine pouch (of Douglas). Laterally, only the fundus is covered because the peritoneum forms a double fold with the uterine tubes in the upper free border. This double fold is the broad ligament, which, at its lateral ends, attaches the uterus to the sides of the pelvis.

**Myometrium.** This is the thickest layer of tissue in the uterine wall. It is a mass of smooth muscle fibres interlaced with areolar tissue, blood vessels and nerves.

**Endometrium.** This consists of columnar epithelium covering a layer of connective tissue containing a large number of mucus-secreting tubular glands. It is richly supplied with blood by spiral arteries, branches of the uterine artery. It is divided functionally into two layers:

1. The functional layer is the upper layer and it thickens and becomes rich in blood vessels in the first half of the menstrual cycle. If the ovum is not fertilized and does not implant, this layer is shed during menstruation.
2. The basal layer lies next to the myometrium, and is not lost during menstruation. It is the layer from which the fresh functional layer is regenerated during each cycle.

The upper two-thirds of the cervical canal is lined with this mucous membrane. Lower down, however, the mucosa changes, becoming stratified squamous epithelium, which is continuouswith the lining of the vagina itself.

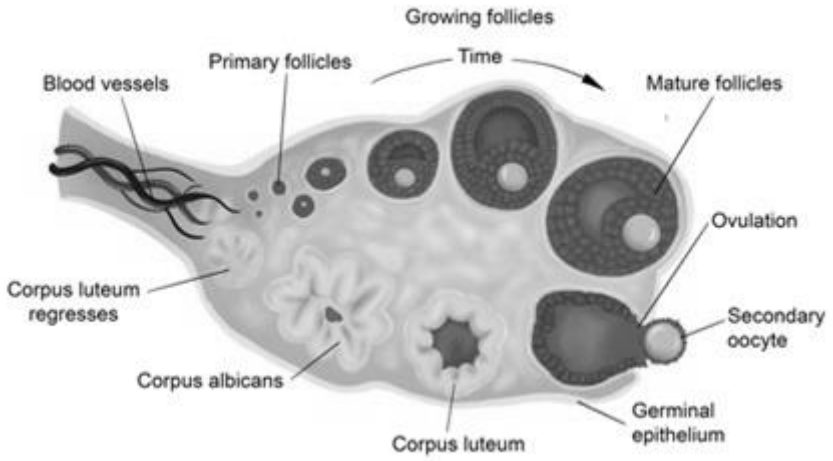
## Uterine tubes

The uterine (Fallopian) tubes are about 10 cm long and extend from the sides of the uterus between the body and the fundus. They lie in the upper free border of the broad ligament and their trumpet-shaped lateral ends penetrate the posterior wall, opening into the peritoneal cavity close to the ovaries. The end of each tube has finger like projections called fimbriae. The longest of these is the ovarian fimbria, which is in close association with the ovary.

The uterine tubes are covered with peritoneum (broad ligament), have a middle layer of smooth muscle and are lined with ciliated epithelium. Blood and nerve supply and lymphatic drainage are as for the uterus.

## Ovaries

The ovaries are the female gonads (glands producing sex hormones and the ova), and they lie in a shallow fossa on the lateral walls of the pelvis. They are 2.5–3.5 cm long, 2 cm wide and 1 cm thick. Each is attached to the upper part of the uterus by the ovarian ligament and to the back of the broad ligament by a broad band of tissue, the mesovarium. Blood vessels and nerves pass to the ovary through the mesovarium.




*Structure of ovary*

## Structure of ovaries

The ovaries have two layers of tissue.

**Medulla:** This lies in the centre and consists of fibrous tissue, blood vessels and nerves.

**Cortex:** This surrounds the medulla. It has a framework of connective tissue, or stroma, covered by germinal epithelium. It contains ovarian follicles in various stages of maturity,each of which contains an ovum. Before puberty the ovaries are inactive but the stroma already contains immature (primordial) follicles, which the female has from birth. During the childbearing years, about every 28 days, one or more ovarian follicle (Graafian follicle) matures ruptures and releases its ovum into the peritoneal cavity. This is called ovulation and it occurs during most menstrual cycles. Following ovulation, the ruptured follicle develops into the corpus luteum (meaning 'yellow body'), which in turn will leave a small permanent scar of fibrous tissue called the corpus albicans (meaning 'white body') on the surface of the ovary.

# MALE REPRODUCTIVE SYSTEM

The functions of the male reproductive organs are:

- Production, maturation and storage of spermatozoa
- Delivery of spermatozoa in semen into the female reproductive tract.The urethra is also the passageway for urine excretion.

## Scrotum

The scrotum is a pouch of pigmented skin, fibrous and connective tissue and smooth muscle. It is divided into two compartments, each of which contains one testis, one epididymis and the testicular end of a spermatic cord. It lies below the symphysis pubis, in front of the upper parts of the thighs and behind the penis.

## Testes

The testes are the male reproductive glands and are the equivalent of the ovaries in the female. They are about 4.5 cm long, 2.5 cm wide and 3 cm thick and are suspended in the scrotum by the spermatic cords. They are surrounded by three layers of tissue.

**1. Tunica vaginalis:** This is a double membrane, forming the outer covering of the testes, and isa down growth of the abdominal and pelvic peritoneum. During early fetal life, the testes develop in the lumbar region of the abdominal cavity just below the kidneys. They then descend into the scrotum, taking with them coverings of peritoneum, blood and lymph vessels, nerves and the deferent duct. The peritoneum eventually surrounds the testes in the scrotum, and becomes detached from the abdominal peritoneum.

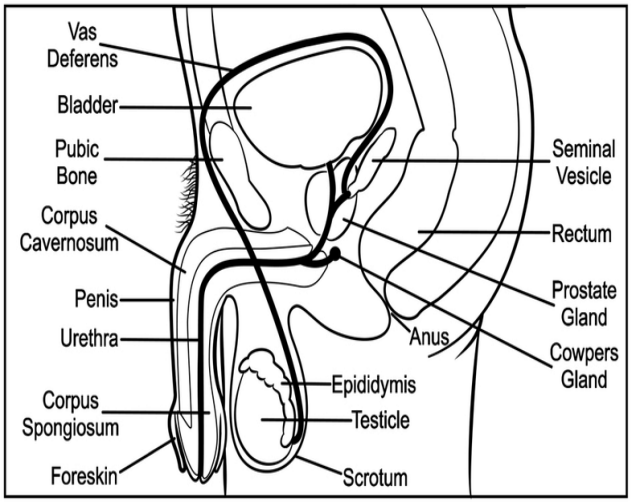
Descent of the testes into the scrotum should be complete by the 8th month of fetal life.

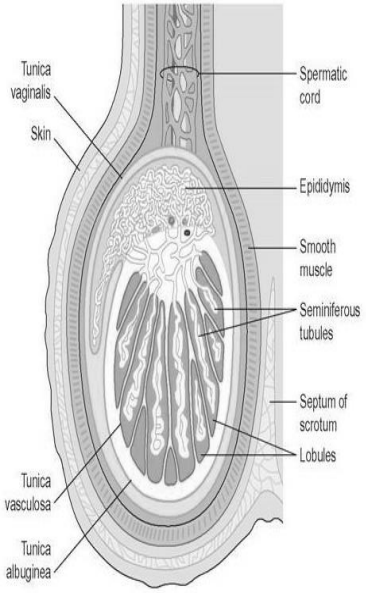
**2. Tunica albuginea:** This is a fibrous covering beneath the tunica vaginalis. Ingrowths formsepta, dividing the glandular structure of the testes into lobules.

**3. Tunica vasculosa:** This consists of a network of capillaries supported by delicate connectivetissue.

## Structure of testis

In each testis are 200–300 lobules, and within each lobule are 1–4 convoluted loops of germinal epithelial cells, called seminiferous tubules. Between the tubules are groups of interstitial cells (of Leydig) that secrete the hormone testosterone after puberty. At the upper pole of the testis the tubules combine to form a single tubule. This tubule, about 6 m in its full length, is repeatedly folded and tightly packed into a mass called the epididymis. It leaves the scrotum as the deferent duct (vas deferens) in the spermatic cord. Blood and lymph vessels pass to the testes in the spermatic cords.




***Structure of the testis and its coverings***

**1. Spermatic cords**

The spermatic cords suspend the testes in the scrotum.

Each cord contains a testicular artery, testicular veins, lymphatics, a deferent duct and testicular nerves, which come together to form the cord from their various origins in the abdomen. The cord, which is covered in a sheath of smooth muscle and connective and fibrous tissues, extends through the inguinal canal and is attached to the testis on the posterior wall.

**2. The deferent duct**

This is some 45 cm long. It passes upwards from the testis through the inguinal canal and ascends medially towards the posterior wall of the bladder where it is joined by the duct from the seminal vesicle to form the ejaculatory duct.

**3. Seminal vesicles**

The seminal vesicles are two small fibromuscular pouches, 5 cm long, lined with columnar epithelium and lying on the posterior aspect of the bladder. At its lower end each seminal vesicle opens into a short duct, which joins with the corresponding deferent duct to form an ejaculatory duct.The seminal vesicles contract and expel their stored contents, seminal fluid, during ejaculation. Seminal fluid, which forms 60% of the volume of semen, is alkaline to protect the sperm in the acidic environment of the vagina, and contains fructose to fuel the sperm during their journey through the female reproductive tract.

**3. Ejaculatory ducts**

The ejaculatory ducts are two tubes about 2 cm long, each formed by the union of the duct from a seminal vesicle and a deferent duct. They pass through the prostate gland

and join the prostatic urethra, carrying seminal fluid and spermatozoa to the urethra.

The walls of the ejaculatory ducts are composed of the same layers of tissue as the seminal vesicles.

**Prostate gland**

The prostate gland lies in the pelvic cavity in front of the rectum and behind the symphysis pubis, completely surrounding the urethra as it emerges from the bladder. It has an outer fibrous covering, enclosing glandular tissue wrapped in smooth muscle. The gland weighs about 8 g in youth, but progressively enlarges (hypertrophies) with age and is likely to weigh about 40 g by the age of 50.The prostate gland secretes a thin, milky fluid that makes up about 30% of the volume of semen, and gives it its milky appearance. It contains a clotting enzyme, which thickens the semen in the vagina, increasing the likelihood of semen being retained close to the cervix.

**Urethra**

The male urethra provides a common pathway for the flow of urine and semen. It is about 19–20 cm long and consists of three parts. The prostatic urethra originates at the urethral orifice of the bladder and passes through the prostate gland. The membranous urethra is the shortest and narrowest part and extends from the prostate gland to the bulb of the penis, after passing through the perineal membrane. The spongiose or penile urethra lies within the corpus spongiosum of the penis and terminates at the external urethral orifice in the glans penis. There are two urethral sphincters. The internal sphincter is a ring of smooth muscle at the neck of the bladder above the prostate gland. The external sphincter is a ring of skeletal muscle surrounding the membranous part.

**Penis**

The penis has a root and a shaft. The root anchors the penis in the perineum and the shaft (body) is the externally visible, moveable portion of the organ. It is formed by three cylindrical masses of erectile tissue and smooth muscle. The erectile tissue is supported by fibrous tissue and covered with skin and has a rich blood supply. The two lateral columns are called the corpora cavernosa and the column between them, containing the urethra, is the corpus spongiosum. At its tip it is expanded into a triangular structure known as the glans penis. Just above the glans the skin is folded upon itself and forms a movable double layer,the foreskin or prepuce. Arterial blood is supplied by deep, dorsal and bulbar arteries of the penis, which are branches from the internal pudendal arteries. A series of veins drain blood tothe internal pudendal and internal iliac veins. The penis is supplied by autonomic and somaticnerves. Parasympathetic stimulation leads to filling of

the spongy erectile tissue with blood, caused by arteriolar dilation and venoconstriction, which increases blood flow into the penis and obstructs outflow. The penis therefore becomes engorged and erect, essential for sexual intercourse.

## PHYSIOLOGY OF FEMALE REPRODUCTIVE SYSTEM

The functions of the female reproductive system are:

1. Formation of ova
2. Reception of spermatozoa
3. Provision of suitable environments for fertilisation and fetal development
4. Parturition (childbirth)

### The reproductive cycle (Physiology of Menstruation)

This is a series of events, occurring regularly in females every 26 to 30 days throughout the childbearing period between menarche and menopause. The cycle consists of a series of changes taking place concurrently in the ovaries and uterine lining, stimulated by changes in blood concentrations of hormones.

Hormones secreted during the cycle are regulated by negative feedback mechanisms: The hypothalamus secretes luteinising hormone releasing hormone (LHRH), which stimulates the anterior pituitary to secrete:

1. Follicle stimulating hormone (FSH), which promotes the maturation of ovarian follicles and the secretion of oestrogen, leading to ovulation. FSH is therefore predominantly active in the first half of the cycle. Its secretion is suppressed once ovulation has taken place, to prevent other follicles maturing during the current cycle.
2. Luteinising hormone (LH), which triggers ovulation, stimulates the development of the corpus luteum and the secretion of progesterone.

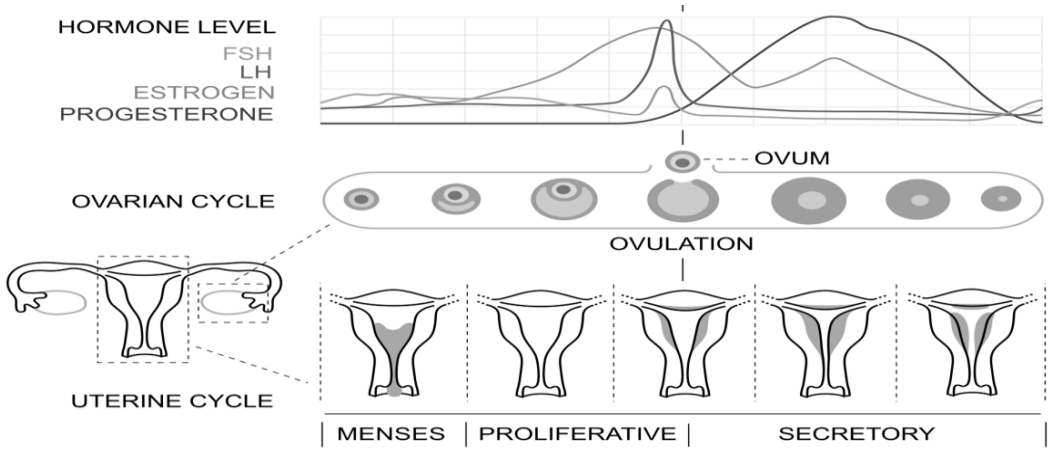
The hypothalamus responds to changes in the blood levels of oestrogen and progesterone. It is stimulated by high levels of oestrogen alone (as happens in the first half of the cycle) but suppressed by oestrogen and progesterone together (as happens in the second half of the cycle).

The average length of the cycle is about 28 days. By convention the days of the cycle are numbered from the beginning of the menstrual phase, which usually lasts about 4 days. This is followed by the proliferative phase (approximately 10 days), then by the secretory phase (about 14 days).

### 1. Menstrual phase

When the ovum is not fertilised, the corpus luteum starts to degenerate.(In the event of pregnancy, the corpus luteum is supported by human chorionic gonadotrophin [HCG] secreted by the developing embryo.) Progesterone and oestrogen levels therefore fall, and the functional layer of the endometrium, which is dependent on high levels of these ovarian hormones, is shed in menstruation. The menstrual flow consists of the secretions from endometrial glands, endometrial cells, blood from the degenerating capillaries and the unfertilised ovum.

During the menstrual phase, levels of oestrogen and progesterone are very low because the corpus luteum that had been active during the second half of the previous cycle has degenerated. This means the hypothalamus and anterior pituitary can resume their cyclical activity, and levels of FSH begin to rise, initiating a new cycle.




*Physiology of Menstruation*

### 2. Proliferative phase

At this stage an ovarian follicle, stimulated by FSH, is growing towards maturity and is producing oestrogen, which stimulates proliferation of the functional layer of the endometrium in preparation for the reception of a fertilised ovum. The endometrium thickens, becoming very vascular and rich in mucus-secreting glands. Rising levels of oestrogen are responsible for triggering a surge of LH approximately mid-cycle. This LH surge triggers ovulation, marking the end of the proliferative phase.

### 3. Secretory phase

After ovulation, LH from the anterior pituitary stimulates development of the corpus luteum from the ruptured follicle, which produces progesterone, some oestrogen, and

inhibin. Under the influence of progesterone, the endometrium becomes oedematous and the secretory glands produce increased amounts of watery mucus. This assists the passage of the spermatozoa through the uterus to the uterine tubes where the ovum is usually fertilised.

There is a similar increase in secretion of watery mucus by the glands of the uterine tubes andby cervical glands that lubricate the vagina.

The ovum may survive in a fertilisable form for a very short time after ovulation, probably as little as 8 hours. The spermatozoa, deposited in the vagina during intercourse, may be capable of fertilising the ovum for only about 24 hours although they can survive for several days. This means that the period in each cycle during which fertilisation can occur is relatively short. Observable changes in the woman's body occur around the time of ovulation. Cervical mucus, normally thick and dry, becomes thin, elastic and watery, and body temperature rises by about 1°C immediately following ovulation.

Some women experience abdominal discomfort in the middle of the cycle, thought to correspond to rupture of the follicle and release of its contents into the abdominal cavity.

After ovulation, the combination of progesterone, oestrogen and inhibin from the corpus luteum suppresses the hypothalamus and anterior pituitary, so FSH and LH levels fall. Low FSH levels in the second half of the cycle prevent further follicular development in case a pregnancy results from the current cycle. If the ovum is not fertilised, falling LH levels leads to degeneration and death of the corpus luteum, which is dependent on LH for survival. The resultant steady decline in circulating oestrogen, progesterone and inhibin leads to degeneration of the uterine lining and menstruation, with the initiation of a new cycle.

If the ovum is fertilised there is no breakdown of the endometrium and no menstruation. The fertilised ovum (zygote) travels through the uterine tube to the uterus where it becomes embedded in the wall and produces human chorionic gonadotrophin (HCG), which is similar to anterior pituitary luteinising hormone. This hormone keeps the corpus luteum intact, enabling it to continue secreting progesterone and oestrogen for the first 3–4 months of the pregnancy, inhibiting the maturation of further ovarian follicles. During that time the placentadevelops and produces oestrogen, progesterone and gonadotrophins.

## Menopause

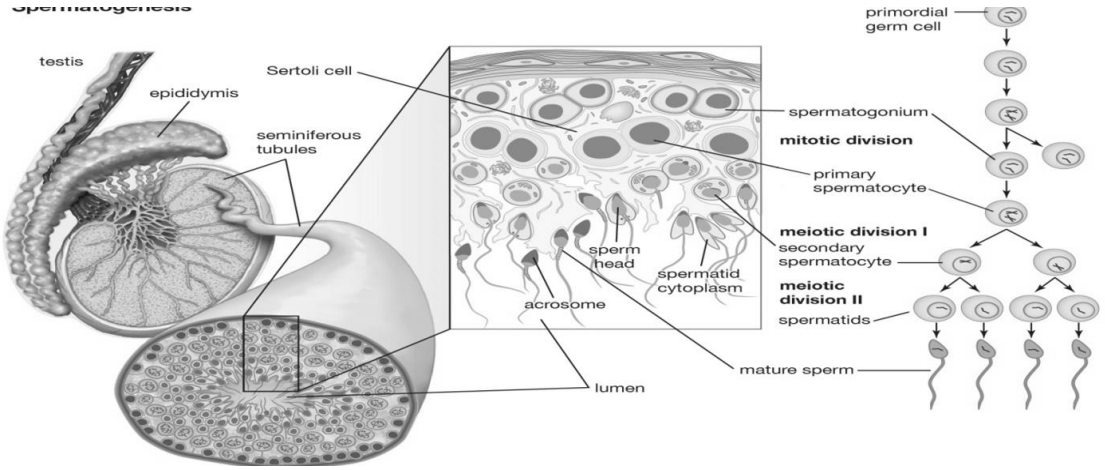
The menopause (climacteric) usually occurs between the ages of 45 and 55 years, marking the end of the childbearing period. It may occur suddenly or over a period of years, sometimes as long as 10 years, and is caused by a progressive reduction in oestrogen levels, as the number of functional follicles in the ovaries declines with age. The ovaries gradually become less responsive to FSH and LH, and ovulation and the menstrual cycle become irregular, eventually ceasing.

## Spermatogenesis

During formation of the embryo, the primordial germ cells migrate into the testes and become immature germ cells called spermatogonia which lie in two or three layers of the inner surfaces of the seminiferous tubules. The spermatogonia begin to undergo mitotic division, beginning at puberty, and continually proliferate and differentiate through definite stages of development to form sperm.

## Steps of Spermatogenesis

Spermatogenesis occurs in the seminiferous tubules during active sexual life as the result of stimulation by anterior pituitary gonadotropic hormones, beginning at an average age of 13 years and continuing throughout most of the remainder of life but decreasing markedly in old age.




*Physiology of Spermatogenesis*

In the first stage of spermatogenesis, the spermatogonia migrate among Sertoli cells toward the central lumen of the seminiferous tubule. The Sertoli cells are very large, with overflowing cytoplasmic envelopes that surround the developing spermatogonia all the way to the central lumen of the tubule.

**1. Meiosis:** Spermatogonia that cross the barrier into the Sertoli cell layer become progressively modified and enlarged to form large primary spermatocytes. Each of these, in turn, undergoes meiotic division to form two secondary spermatocytes. After another few days, these too divide to form spermatids that are eventually modified to become spermatozoa (sperm).

During the change from the spermatocyte stage to the spermatid stage, the 46 chromosomes (23 pairs of chromosomes) of the spermatocyte are divided, so that 23 chromosomes go to one spermatid and the other 23 to the second spermatid. This also divides the chromosomal genes so that only one half of the genetic characteristics of the eventual fetus are provided by the father, while the other half are derived from the oocyte provided by the mother.

The entire period of spermatogenesis, from spermatogonia to spermatozoa, takes about 74 days.

**2. Sex Chromosomes:** In each spermatogonium, one of the 23 pairs of chromosomes carries the genetic information that determines the sex of each eventual offspring. This pair is composed of one X chromosome, which is called the female chromosome, and one Y chromosome, the male chromosome. During meiotic division, the male Y chromosome goes to one spermatid that then becomes a male sperm, and the female X chromosome goes to another spermatid that becomes a female sperm. The sex of the eventual offspring is determined by which of these two types of sperm fertilizes the ovum.

**3. Formation of Sperm:** When the spermatids are first formed, they still have the usual characteristics of epithelioid cells, but soon they begin to differentiate and elongate into spermatozoa. Each spermatozoon is composed of a head and a tail. The head comprises the condensed nucleus of the cell with only a thin cytoplasmic and cell membrane layer around its surface. On the outside of the anterior two thirds of the head is a thick cap called the acrosome that is formed mainly from the golgi apparatus. This contains a number of enzymes similar to those found in lysosomes of the typical cell, including hyaluronidase (which can digest proteoglycan filaments of tissues) and powerful proteolytic enzymes (which can digest proteins). These enzymes play important roles in allowing the sperm to enter the ovum and fertilize it.

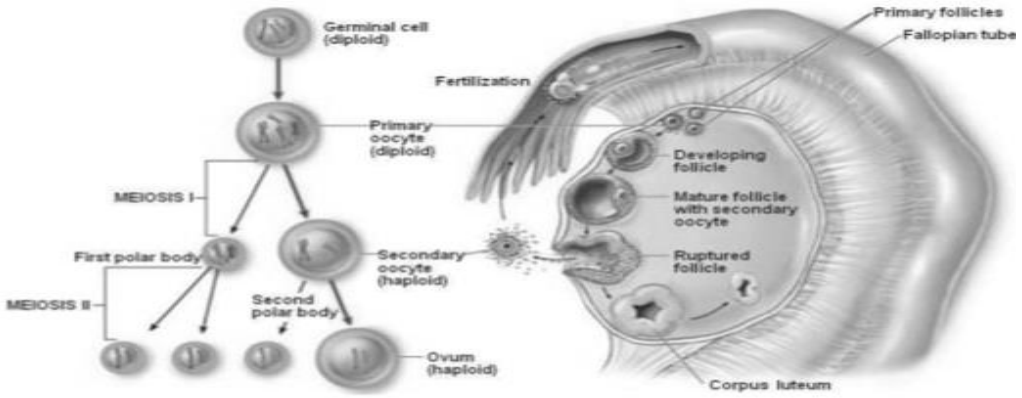
The tail of the sperm, called the flagellum, has three major components:

1. A central skeleton constructed of 11 microtubules, collectively called the axoneme
2. A thin cell membrane covering the axoneme.

3. A collection of mitochondria surrounding the axoneme in the proximal portion of thetail (called the body of the tail).

Normal sperm move in a fluid medium at a velocity of 1 to 4 mm/min. This allows them tomove through the female genital tract in quest of the ovum.

## Oogesnesis




***Physiology of Oogesnesis***

When a female child is born, each ovum is surrounded by a single layer of granulose cells; the ovum, with this granulosa cell sheath, is called a primordial follicle.

Throughout childhood, the granulosa cells are believed to provide nourishment for the ovum and to secrete an oocyte maturation-inhibiting factor that keeps the ovum suspended in its primordial state in the prophase stage of meiotic division. Then, after puberty, when FSH and LH from the anterior pituitary gland begin to be secreted in significant quantities, the ovaries,together with some of the follicles within them, begin to grow.

The first stage of follicular growth is moderate enlargement of the ovum itself, which increases in diameter twofold to threefold.Then follows growth of additional layers of granulosa cells in some of the follicles; these follicles are known as primary follicles.

During the first few days of each monthly female sexual cycle, the concentrations of both FSH and LH secreted by the anterior pituitary gland increase slightly to moderately, with the increase in FSH slightly greater than that of LH and preceding it by a few days. These hormones, especially FSH, cause accelerated growth of 6 to 12 primary follicles each month. The initial effect is rapid proliferation of the granulosa cells, giving rise to many more layers of these cells. In addition, spindle cells derived from the ovary interstitium collect in several layers outside the granulosa cells, giving rise to a second mass of cells called the theca. This is divided into two layers. In the theca interna, the cells take on epithelioid characteristics similar to those of the

granulose cells and develop the ability to secrete additional steroid sex hormones (estrogen and progesterone).

The outer layer, the theca externa, develops into a highly vascular connective tissue capsule that becomes the capsule of the developing follicle. After the early proliferative phase of growth, lasting for a few days, the mass of granulosa cells secretes a follicular fluid that contains a high concentration of estrogen, one of the important female sex hormones. Accumulation of this fluid causes an antrum to appear within the mass of granulosa cells.

The early growth of the primary follicle up to the antral stage is stimulated mainly by FSH alone. Then greatly accelerated growth occurs, leading to still larger follicles called vesicular follicles. This accelerated growth is caused by the following:

(1) Estrogen is secreted into the follicle and causes the granulosa cells to form increasing numbers of FSH receptors; this causes a positive feedback effect, because it makes the granulosa cells even more sensitive to FSH.

(2) The pituitary FSH and the estrogens combine to promote LH receptors on the original granulosa cells, thus allowing LH stimulation to occur in addition to FSH stimulation and creating an even more rapid increase in follicular secretion.

(3) The increasing estrogens from the follicle plus the increasing LH from the anterior pituitary gland act together to cause proliferation of the follicular thecal cells and increase their secretion as well.

Once the antral follicles begin to grow, their growth occurs almost explosively. The ovum itself also enlarges in diameter another threefold to fourfold, giving a total ovum diameter increase up to 10- fold, or a mass increase of 1000-fold. As the follicle enlarges, the ovum itself remains embedded in a mass of granulosa cells located at one pole of the follicle.

Only one follicle fully matures each month, and the remainder Undergo atresia. After a week or more of growth— but before ovulation occurs—one of the follicles begins to outgrow all the others; the remaining 5 to 11 developing follicles involute (a process called atresia), and these follicles are said to become atretic.

This process of atresia is important, because it normally allows only one of the follicles to grow large enough each month to ovulate; this usually prevents more than one child from developing with each pregnancy. The single follicle reaches a diameter of 1 to 1.5 centimeters at the time of ovulation and is called the mature follicle.

## PREGNANCY

If the ovum becomes fertilized, a new sequence of events called gestation, or pregnancy, takes place, and the fertilized ovum eventually develops into a full-term fetus.

**1. Fertilization of the Ovum:** After the male ejaculates semen into the vagina during intercourse, a few sperm are transported within 5 to 10 minutes upward from the vagina and through the uterus and fallopian tubes to the ampullae of the fallopian tubes near the ovarian ends of the tubes. This transport of the sperm is aided by contractions of the uterus and fallopian tubes stimulated by prostaglandins in the male seminal fluid and also by oxytocin released from the posterior pituitary gland of the female during her orgasm. Of the almost half a billion sperm deposited in the vagina, a few thousand succeed in reaching each ampulla.

**2. Transport of the fertilized ovum in the fallopian tube**

After fertilization has occurred, an additional 3 to 5 days is normally required for transport of the fertilized ovum through the remainder of the fallopian tube into the cavity of the uterus. This transport is affected mainly by a feeble fluid current in the tube resulting from epithelial secretion plus action of the ciliated epithelium that lines the tube; the cilia always beat towardthe uterus. Weak contractions of the fallopian tube may also aid the ovum passage.

This delayed transport of the fertilized ovum through the fallopian tube allows several stages of cell division to occur before the dividing ovum—now called a blastocyst, with about 100 cells—enters the uterus. During this time, the fallopian tube secretory cells produce large quantities of secretions used for the nutrition of the developing blastocyst.

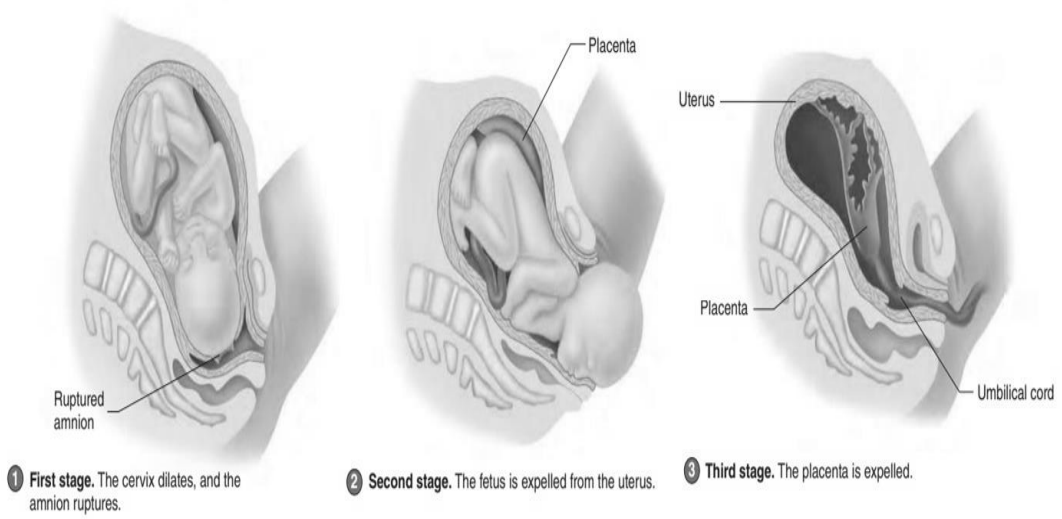
**3. Implantation of the Blastocyst in the Uterus**

After reaching the uterus, the developing blastocyst usually remains in the uterine cavity an additional 1 to 3 days before it implants in the endometrium; thus, implantation ordinarily occurs on about the fifth to seventh day after ovulation. Before implantation, the blastocyst obtains its nutrition from the uterine endometrial secretions, called “uterine milk.” Implantation results from the action of trophoblast cells that develop over the surface of the blastocyst. These cells secrete proteolytic enzymes that digest and liquefy the adjacent cells of the uterine endometrium. Some of the fluid and nutrients released are actively transportedby the same trophoblast cells into the blastocyst, adding more sustenance for growth.

Once implantation has taken place, the trophoblast cells and other adjacent cells (from the blastocyst and the uterine endometrium) proliferate rapidly, forming the placenta and the various membranes of pregnancy.

## Parturition

Parturition means birth of the baby. Toward the end of pregnancy, the uterus becomes progressively more excitable, until finally it develops such strong rhythmical contractions that the baby is expelled. The exact cause of the increased activity of the uterus is not known, but at least two major categories of effects lead up to the intense contractions responsible for parturition:




### *Physiology of Parturition*

The uterine contractions during labor begin mainly at the top of the uterine fundus and spreaddownward over the body of the uterus. Also, the intensity of contraction is great in the top and body of the uterus but weak in the lower segment of the uterus adjacent to the cervix.

Therefore, each uterine contraction tends to force the baby downward toward the cervix. In the early part of labor, the contractions might occur only once every 30 minutes. As labor progresses, the contractions finally appear as often as once every 1 to 3 minutes, and the intensity of contraction increases greatly, with only a short period of relaxation between contractions. The combined contractions of the uterine and abdominal musculature during delivery of the baby cause a downward force on the fetus of about 25 pounds during each strong contraction.

In about 95 per cent of births, the head is the first part of the baby to be expelled, and in

most of the remaining instances, the buttocks are presented first. The head acts as a wedge to open the structures of the birth canal as the fetus is forced downward.

Once the cervix has dilated fully, the fetal membranes usually rupture and the amniotic fluidis lost suddenly through the vagina. Then the fetus's head moves rapidly into the birth canal, and with additional force from above, it continues to wedge its way through the canal until delivery is affected. This is called the second stage of labor, and it may last from as little as 1 minute after many pregnancies to 30 minutes or more in the first pregnancy.

**Very Short Answer Type Question (2Marks)**

1.Write short notes on

a. Menopause
b. Parturition
c. Oogenesis
d. Spermatogenesis

**Short Answer Type Question (5 Marks)**

1. Explain anatomy and functions of ovaries.
2. Explain the phases of menstruation cycle.
3. Explain anatomy and functions of testes.

**Long Answer Type Question (10 Marks)**

1. Describe the structure of female reproductive system.
2. Describe the structure of male reproductive system.