

CHAPTER 3

HUMAN REPRODUCTION

Topics Discussed

INTRODUCTION

MALE AND FEMALE REPRODUCTIVE SYSTEMS

MICROSCOPIC ANATOMY OF THE TESTIS AND

OVARY

GAMETOGENESIS MENSTRUAL CYCLE

FERTILIZATION

EMBRYO DEVELOPMENT

IMPLANTATION

PREGNANCY AND PLACENTA FORMATION

PARTURITION (ELEMENTARY IDEA)

LACTATION (ELEMENTARY IDEA)

1. Introduction

Sexual reproduction is a process by which organisms produce offspring through the union of male and female germ cells which are also known as **gametes**.

The union of the male and female gamete is called fertilization. The cell resulting from this union will have one set of chromosomes from each parent.

Males and females generally have anatomically distinct reproductive organs that are adapted for producing gametes, facilitating fertilization, and in females it will also sustain the growth and the development of the growing fetus.

We can group the male and female reproductive organs according to their function:

- **The gonads:** The testes in males and ovaries in females produce gametes and secrete sex hormones.
- **Ducts:** There is a ductal system which then stores and transports the gametes.

1. **Accessory sex glands:** They produce the substances that protect the gametes and facilitate their movements.
2. **Supporting structures:** Such as the penis in males and the vagina in females, assist the delivery of gametes, and the uterus in females assist in growth of the embryo in and fetus during pregnancy.

Objectives

At the end of this chapter, you will be able to:

- Understanding of sexual reproduction in human.
- Structural and physiological anatomy of male and female sexual organs
- Gametogenesis
- Role of menstrual cycle in reproduction
- Fertilization and further consecutive events leading to conception
- Overall idea of pregnancy, role of placenta and parturition



KNOWLEDGE BUILDER

- Gynecology is the specialized branch of medicine which deals with the diagnosis of treatment of diseases of the reproductive system
- The branch of medicine that deals with male disorders, especially infertility and sexual dysfunction is called **Andrology**.

2. Male Reproductive System

The functions of the male reproductive system can be divided into these major subdivisions:

- **Spermatogenesis** – meaning the formation of sperms
- **Regulation** of male reproductive function by various **hormones**.
- Transfer of sperms

Organs of the male reproductive system:

- **Testes** – Male gonads
- **System of ducts** – Epididymis, ductus deferens or the vasa deferentia, ejaculatory ducts, and the urethra.
- **Accessory sex glands** – Seminal vesicles, prostate and bulbourethral or Cowper's glands
- Several external supporting structures like scrotum and penis.

Human Male Reproductive System

It consists of the following parts:

- **Scrotum:** Externally it looks like a pouch of pigmented skin separated into lateral portions by a median ridge called raphe. Internally, scrotal septum divides it into two separate sacs. Each sacs has one testis. Normal temperature of testes in the scrotum is about 2-3°C lower than the internal body temperature. This temperature is ideal for developing sperms. The scrotum remains connected with the abdomen or pelvic cavity by the inguinal canals. The spermatic cord which is formed from the spermatic artery, vein and nerves bound together with the connective tissue passes into the testis through the inguinal canal.
- **Testes:** They are the primary sex organs in man or the male gonads. They develop during the early fetal life in the abdominal cavity but during the 7th month of development they descend into the scrotum through the inguinal canals. This event is called as descent of testis. Therefore, a pair of testis is suspended in the scrotum by the spermatic cords. A fibrous cord that extends the caudal end of the scrotal wall is called **gubernaculum**.
 - **Features of the testis:** Each testis is oval in shape with a length of 4 - 5 cm and a width of 2 - 3 cm. A peritoneal covering called mesorchium supports the testis.
 - **Protective coverings of the testis or the tunicae:** The testis is covered by serous membrane called tunica vaginalis derived from the peritoneum and forms during the descent of the testis. Internal to the visceral layer, the testis is surrounded by a white fibrous capsule composed of dense irregular connective tissue, the tunica albuginea. It extends inwards forming the septa that divides each testes into internal compartments called as **lobules**. The tunica vasculosa consists of a network of capillaries supported by delicate connective tissue which lines the tunica albuginea.
 - **Testicular lobules:** There are around 200 - 300 lobules in each testis, each lobule contains 1 to 3 tightly coiled tubules, the seminiferous tubules. Seminiferous tubules are where the sperms are actually produced. The process by which the seminiferous tubules of the testes produce sperms is called spermatogenesis. The walls of the seminiferous tubules contain two types of cells:
 - i. **Spermatogenic cells:** The sperm forming cells
 - ii. **Sustentacular cells or the cells of Sertoli:** They have several functions in supporting spermatogenesis.
 - **Cells of Sertoli:** They support developing germ cells and provide them with nutrition especially

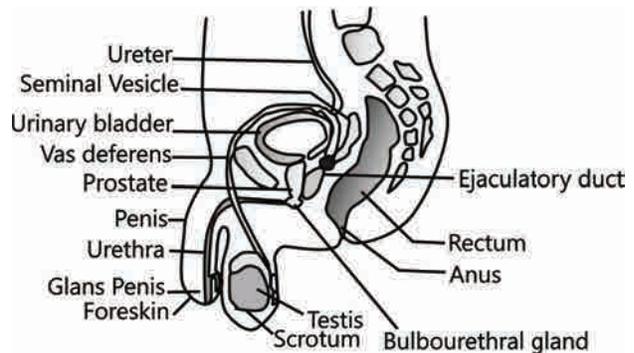


Figure 3.1: Side view of the male reproductive anatomy

spermatids. Sertoli cells secrete androgen binding protein (ABP) that concentrates testosterone in the seminiferous tubules. Sertoli cells secrete another protein called inhibin which suppresses FSH synthesis. The cuboidal cells undergo mitosis to produce spermatogonia. Spermatogonia grow into primary spermatocytes which undergo meiosis, producing haploid cells, first secondary spermatocytes and then the spermatids. The latter convert into spermatozoa (sperms). Sertoli cells provide nutrition to the developing sperms.

- **Interstitial cells or the Leydig's cells:** This is the endocrine portion of the testes. In the spaces between adjacent seminiferous tubules are a cluster of cells called the **interstitial cells** or **Leydig's cells**. They secrete testosterone, the most important Androgen. Androgen is a hormone that promotes the development of masculine characteristics. Testosterone also promotes a man's **libido (sex drive)**.
- **Rete testis:** Also known as vasa efferentia they are a part of the testis as well. The seminiferous tubules are closed at one end but on the other side they join to form a network the rete testis from whose ciliated ductules, the vasa efferentia arise.

Thus the functions of the testis are basically I) production of sperms; II) secretion of male sex hormones.

Did You Know

In response to cold temperature the **dartos muscle** (or the smooth muscles present in the septum) along with the **cremaster muscle** (which is a series of band of small skeletal muscles which are associated with the testis in the scrotum), contract which brings the testes closer to the where they can absorb body heat. Thus temperature regulation of the testes is maintained by the scrotum.

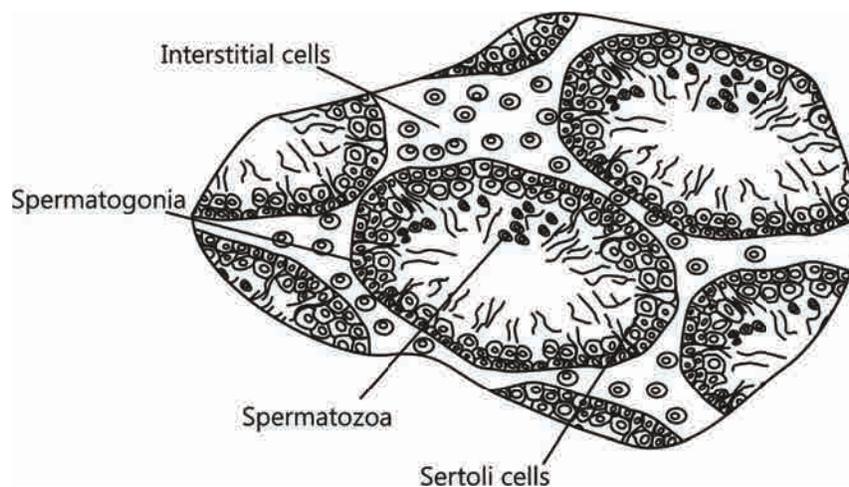


Figure 3.2: Diagram of a section of a seminiferous tubule

- **Reproductive System Ducts in Males:**

- **Epididymis:** The epididymis is a comma shaped organ about 4 cm which is a mass of long narrow closely coiled tubule which lies along the posterior border of each testis. At the anterior end of the testis it is called caput epididymis (caput means head), the middle part is called the **corpus epididymis** (corpus means the body) and posterior end part is called as **cauda epididymis** (cauda means tail).

Functions: The epididymis stores the sperms and also secretes a fluid which is considered to nourish the sperms.

- **Vasa deferentia:** At its distal end the cauda epididymis continues as the ductus epididymis which is measured about 6 mt. or 20 ft. in length when straightened out. In the tail or cauda epididymis the ductus becomes less convoluted and its diameter increases. Beyond this point the duct is referred to as the ductus deferens or vas deferens. The vas deferens leaves the scrotal sac and enters the abdominal cavity through the inguinal canal. The vas deferens loops around the urinary bladder where it is joined by a duct from the seminal vesicle to form the ejaculatory duct.

Function: Vasa deferentia carry sperms.

- **Ejaculatory ducts:** The ejaculatory ducts are two short tubes each formed by the union of a duct from a seminal vesicle and a vas deferens. They pass through the prostatic part of the urethra. The ejaculatory ducts are composed of the fibrous, muscular and columnar epithelial tissue.

Function: Ejaculatory ducts carry sperms and secretions of the seminal vesicles.

- **Urethra:** In male, the urethra is the common duct of the reproductive and urinary systems, it serves as a passageway for both semen and urine. It is about 20 cm or 8 inch. It passes through the prostate, deep muscles of the perineum and its divided into three parts. i) **The prostatic urethra:** It's about 2 - 3 cm long and passes through the prostate. ii) **The membranous urethra:** Further the prostatic urethra through the deep muscles of the perineum where it is known as intermediate or membranous urethra. This is about 1cm in length. iii) **Penile urethra:** As this duct further passes through the corpus spongiosum of the penis, it is known as the penile or spongy urethra which is about 15 to 20 cm long.

The spongy urethra ends at the external urethral orifice also known as the urinary meatus.

There are two **urethral sphincters** – the internal sphincter consists mainly of smooth muscle fibres situated at the neck of the prostate gland and the external sphincter consists of the striated muscle fibres surrounding membranous part of the urethra.

- **Penis:** The penis is male genitalia (male copulatory organ). At the tip of the glans penis (the end part or the penis) is a slit like opening called the **external urethral orifice** or **urinogenital aperture**. The penis performs two main functions i.e. conducting urine from the body and transferring semen into the reproductive tract of the female during sexual intercourse. The penis contains three cylindrical masses of erectile tissue: two dorsal which are called corpora cavernosa and one ventral one called **corpus spongiosum**. A fibrous tissue surrounds these bodies. The corpus spongiosum which contains the penile urethra, get enlarged at the end of the penis and forms the glans penis. This is the most sensitive

part of the penis. The glans penis is covered by a loose fold of skin, the prepuce or foreskin. During sexual arousal the three bundles of tissues in the penis become engorged with blood and cause an erection.

Functions: The penis carries both urine and semen. The penis helps in copulation.

- **Male Accessory glands:**

- **Seminal vesicle:** They are a pair of convoluted, loculated tube like structures which are located near the base of the bladder. Their ducts join the vasa deferentia to form the ejaculatory ducts. They secrete a mucoid material containing fructose, citric acid and other nutrient substances as well as large quantities of prostaglandins and fibrinogen (clotting protein). During the process of emission and ejaculation, each seminal vesicles empties its contents into the ejaculatory duct shortly after the vas deferens empties the sperm. The seminal secretions forms the bulk that is around 60% of the volume of semen. The fructose is a source of energy to the sperm. Prostaglandins help in two ways- They react with the female cervical mucus and make it more receptive to the sperm movement and second they stimulate uterine contractions and thus may help the sperm to be moved towards the female's oviduct, where the fertilization takes place. The clotting proteins help the semen coagulate after ejaculation.
- **Prostate gland:** The prostate gland is simple chestnut shaped gland surrounding the urethra. The prostate gland secretes a thin milky fluid that contains calcium, citrate ion, phosphate ion, a clotting enzyme and **profibrinolysin**. The secretion of prostatic gland adds about 25% to the volume of semen. This secretion is slightly towards alkaline which is quite important because the fluid from vas deferens is slightly acidic due to presence of citric acid in the seminal vesicles and the metabolic end products of the sperms. Also the vaginal secretions of the female are acidic pH 3.5 – 4.0. Sperms do not become motile until the pH rises upto 6.0 – 6.5. Therefore, the alkaline prostatic secretions help in counteracting the acidity and helping the sperms regain motility.
- **Bulbourethral or Cowper's glands:** The **bulbourethral glands** are two small pea shaped structures located on the membranous urethra however their ducts open into the spongy urethra. During sexual arousal the Cowper's glands secrete an alkaline secretion which protects the sperms by neutralizing the acids in the urine in the urethra. At the same time they secrete mucus which lubricates the end of the penis and the lining of the urethra thereby decreasing the number of sperms damaged during ejaculation.
- **Semen:** Semen is a mixture of sperm and secretions of seminal vesicles, prostate and bulbourethral glands. The volume of semen in an ejaculation is 2.5 to 5 ml. with a sperm count concentration of 50 - 150 million per ml. This large number of sperm is required because only a tiny fraction of this number ever reaches the secondary oocyte. Semen has a slightly acidic pH of 7.2 to 7.7. The prostatic secretion gives semen a white colour and milky appearance while the secretions from seminal vesicles and bulbourethral glands give it a sticky consistency. Seminal fluid provides sperms with transportation medium, nutrients and protection from the acidic environment of the male's urethra and the female's vagina.

DID YOU KNOW

Once ejaculated semen coagulates within 5 mins due to presence of clotting proteins of the seminal vesicles. After 10 – 20 minutes semen liquefies because PSA (prostate specific antigen) and proteolytic enzymes produced by the prostate break down the clot. Abnormal or delayed liquefaction of clotted sperm may cause complete or partial immobilization thereby inhibiting their movement through the cervix of the uterus.

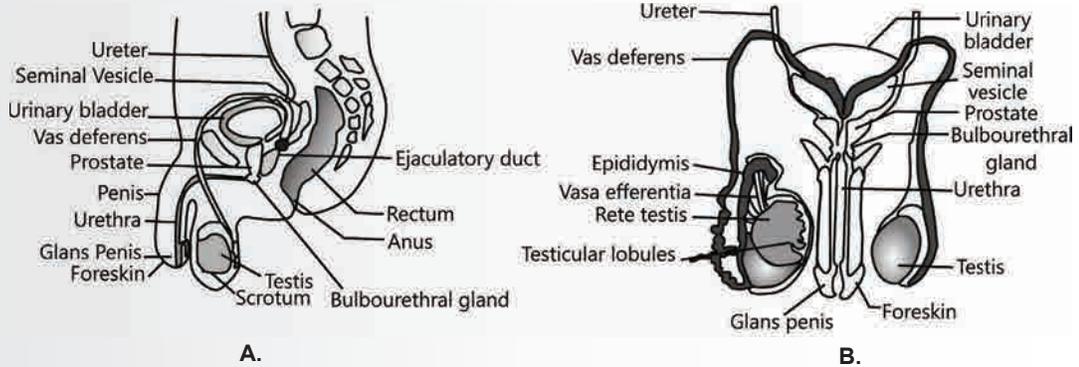


Figure 3.3: Section through male pelvis

A. Sectional view of male pelvis

B. Sectional view of male pelvis with Testis open

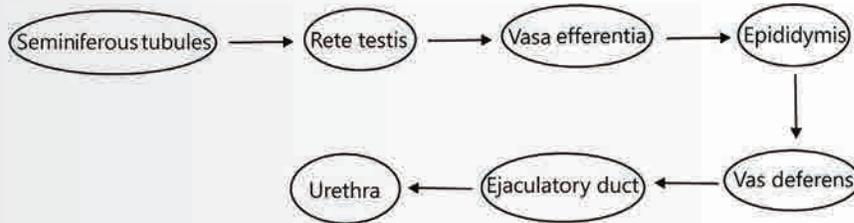


Figure 3.4: Path of the sperm in the male reproductive system

TRY IT YOURSELF

- _____ is a sugar found in semen and is never produced in the female body.
- The pH of the semen from a healthy man is (higher than/lower than/equal to) 7.0.
- In the scrotal sac the testes remain (warmer/cooler) than the core body.

KNOWLEDGE BUILDER

Since fructose is not produced only by seminal vesicles and not produced anywhere in the female body, it provides a great forensic test for rape. The presence of fructose in the female genital tract confirms sexual intercourse.

3. Female Reproductive System

The functions of the female reproductive system can be divided into major parts as follows:

- Preparation of the female body for conception and pregnancy
- The period of pregnancy itself
- Parturition

Organs of the female reproductive system:

- **Ovaries (female gonads)**
- **Uterine tubes**
- **Uterus**
- **Vagina**
- **External genitalia**
- **Breasts**

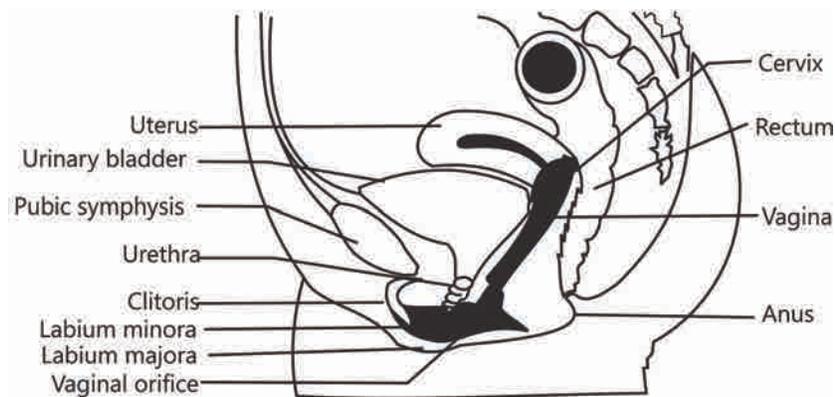


Figure 3.5: Diagrammatic view of a section of the human female pelvis

Human Female Reproductive System

It consists of the following parts:

- **Ovaries:** Ovaries are a pair of glands that are of the shape of unshelled almonds in both size and shape (2 - 4 cm). They are the female gonads. The ovaries one on each side of the uterus descend on the upper part of the superior portion of the pelvic cavity during the third month of development. There are a series of ligaments which hold them in position. The broad ligament of the uterus which is a part of peritoneum attaches to the ovary by a fold of the same which is called the mesovarium. The ovarium ligament anchors the ovaries to the uterus and the suspensory ligament attaches them to the pelvic wall.

The ovary produces female **sex hormones** and **ova**.

The ovary is covered by a layer of cuboidal epithelium called the **germinal epithelium**.

The germinal epithelium is covered by visceral peritoneum. Under the epithelium is the tunica albuginea – layer of connective tissue and underlying it is the ovarian stroma. The ovarian stroma consists of a dense outer layer called the cortex and a less dense inner portion called the **medulla**. The ovarian cortex is a region just beneath the tunica albuginea. It consists of ovarian follicles and surrounded by dense irregular connective tissue. The ovarian medulla is deep to the cortex, the border between the two is indistinct but the medulla has more loosely arranged connective tissue and contains blood vessels, lymphatic vessels and nerves. Ovarian follicles are located in the cortex and they are in various stages of development. The mature (Graafian) follicle is a large fluid filled follicle ready to rupture and release the secondary oocyte. Corpus luteum contains the remnants of the follicle after rupture. In case of no fertilization the corpus luteum degenerates into a fibrous scar called as **Corpus albicans**.

At birth approximately 200,000 – 2,000,000 primary oocyte still remain in each of the ovary. Of these about 40,000 are still present during puberty and around 400 will mature and ovulate during a woman's reproductive period. The remainder of them will undergo atresia (Atresia is a process by which the follicles degenerate). Every month after puberty until menopause under the influence of FSH and LH secreted by the anterior pituitary several primordial follicles develop. Of these only a single reach maturity. The release of secondary oocyte from the ovary is called as **ovulation**. It occurs due to rupturing of ovarian follicle and the wall of the ovary. Generally one oocyte is released every menstrual cycle alternatively from each ovary. In an average reproductive life of a woman which lasts around 40 - 50 years around 400 - 450 ova are produced.

As a follicle starts to grow it becomes the primary follicle. Each primary follicle consists of a primary oocyte surrounded by series of cuboidal and low columnar cells called **granulosa cells**. The outermost granulosa cells rest on a basement membrane.

As the follicle grows it develops a clear glycoprotein layer between the granulosa cells and primary oocyte. And the stromal cells surrounding the basement membrane begin to form an organized layer called **theca folliculi**. Further as the primary follicle matures to form a secondary follicle. In a secondary follicle the theca differentiates into two layers:

- i. **Theca interna** – which is highly vascularized internal layer of cuboidal secretory cells that secrete estrogens.
- ii. **Theca externa** – an external layer of stromal cells and collagen fibres.

Further the granulosa cells begin to secrete a follicular fluid which builds up in the cavity called an **antrum** in the centre of the follicle. The innermost layer of granulosa cells become firmly attached to the zona pellucida and are now called as the **corona radiata**.

While maturing some of the follicle cells produce estrogens, mainly estradiol, after ovulation may cells remain collapsed on the surface of the ovary? The antrum is filled with a partially clotted fluid. The follicular cells then enlarge and filled with yellowish granules called lutein. Such a follicle is called corpus luteum meaning a yellow body.

The lutein cells secrete a significantly large amount of progesterone hormone and a small amount of estradiol. Corpus luteum also secretes relaxin hormone which relaxes the ligaments in the pelvis and softens and widens the cervix in preparation for the childbirth.

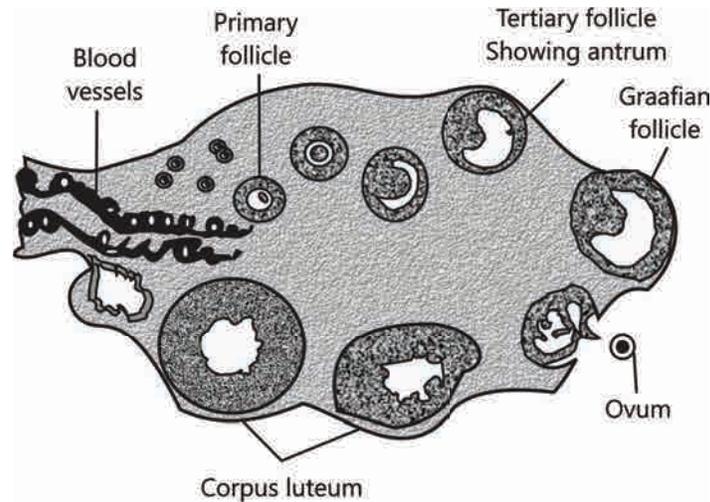


Figure 3.6: Section of the human ovary showing its parts and various stages of follicular developments

- **Fallopian tubules or the oviducts:** Females have a pair of uterine tubes or fallopian tubes or also known as oviducts which extend laterally from the uterus. They are around 10 - 12 cm long. They lie within the folds of the broad ligaments. They transport secondary oocyte and fertilized ova to the uterus. The fallopian tubes have the following parts:
 - **Infundibulum:** It is the funnel or trumpet shaped part of the oviduct. It opens into the peritoneal cavity. The end of the funnel has finger like projections which are called fimbriae whose movements help to collect the ovum after ovulation.
 - **Ampulla:** It is the widest and the longest part of the oviduct which makes up almost two thirds of its length. The ova is fertilized in the ampulla.
 - **Isthmus:** It is the short narrow, thick portion which joins the uterus.
 - The **uterine** part passes through the uterine wall and opens into the uterine cavity.

Functions of the fallopian tubes: It transports the ovum to the uterus through movements called **peristalsis**. Fertilization generally takes place in the ampulla.
- **Uterus:** Also called as **Metra or Hystera or the womb:** Uterus is a muscular, pear shaped bag like structure. It is about 7.5 cm long, 5 cm wide and 2.5 cm thick in non-pregnant females. It is situated in the pelvic cavity in between the urinary bladder and rectum. It is divided into following three parts:
 - i) **Fundus:** The upper dome shaped part above the openings of the uterine parts of the fallopian tubes.
 - ii) **Cornua:** The upper corners where the oviducts enter the uterus.
 - iii) **Corpus:** The body which is the main part and it tapers downwards. The narrowest part of the corpus continues with the cervix.
 - iv) **Cervix:** The part which joins the anterior part of the vagina and opens into it. The cavity of the cervix

is called the cervical canal. It is ring shaped. It communicates with the uterus by an aperture called the **internal os** and with the vagina below by an aperture called the **external os**.

The walls of the uterus are composed of three layers of tissues:

- **Perimetrium:** It is part of the peritoneum and composed of squamous epithelium and thin layer of areolar connective tissue.
- **Myometrium:** It is composed of three layers of smooth muscle fibres that are thickest in the fundus and thinnest in the cervix. During childbirth coordinated contractions in this part help expel the fetus.
- **Endometrium:** It's the inner most vascular and glandular layer lining the uterine cavity. The endometrium is made up of two layers: **i) Stratum functionalis** (functional layer) lines the uterine cavity and sloughs off during menstruation as a result of declining progesterone levels. **ii) Stratum basalis** which is the basal layer and give rise to a new stratum functionalis after each menstruation.

Functions of the uterus: After puberty the uterus undergo through the menstrual cycle. If fertilization takes place then the embryo gets attached to the uterine wall where it is nourished and protected till the end of the gestation period which is concluded when the child is born.

- **Vagina:** Vagina is a tubular canal which is lined by mucous membrane which extends from the exterior of the body to the uterine cervix. It is about 10 cm long (4 inch). It is highly distensible. Its opening at the exterior of the body is called the vaginal orifice which is partially covered by a membrane called the **hymen**. It performs various functions. It serves as a receptacle for the penis during sexual intercourse, the outlet for menstrual flow and the passageway for childbirth.

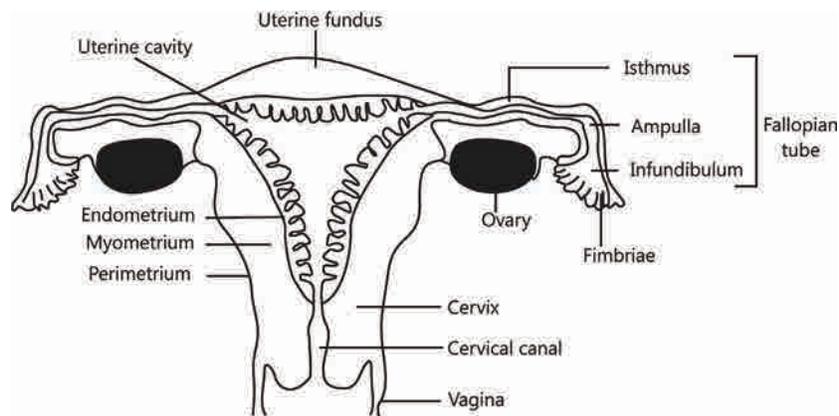


Figure 3.7: Female reproductive system

- **External Genitalia (Vulva):** The female external genitalia are collectively called as vulva. It consists of the following structures.
 - **Mons pubis:** It is an elevation of fatty adipose tissue covered by skin and coarse hair which cushions the pubic symphysis.

- **Labia majora:** These are two thick fleshy folds which form the external boundary of vulva. They are covered partially with pubic hair and they contain a large number of sebaceous glands and apocrine sudoriferous glands (they secrete with a peculiar odor). They are homologous with the scrotum of the male.
- **Labia minora:** These are two smaller folds of skin which lie under the labia majora. They are homologous to penile urethra of the male. At the posterior end the labia minor unite together to form the fourchette. They also have numerous sebaceous glands. They cover area called the **vestibule**. The vestibule is homologous with intermediate urethra of the males.
- **Clitoris:** Posterior to the mons pubis is the clitoris which is a small cylindrical mass of nerves and erectile tissue. It is homologous to glans penis in males. It is different from penis in a way that it is quite reduced in size and it doesn't have any passageway, or in other words it is solid in structure.
- **Vestibule:** The vaginal orifice occupies major portion of the vestibule and is bordered by the hymen. Anterior to the vaginal orifice and posterior to the clitoris is the external urethral orifice or the opening of the urethra to the exterior of the body. On the either side of the external urethral orifice there are opening of the paraurethral glands or Skene's Glands. These mucus secreting glands are located in the walls of the urethra. They are homologous to the prostate. On the either side of the vaginal orifice itself are the greater vestibular glands or Bartholin's glands. They are homologous to the Cowper's glands. They secrete viscous mucoid fluid which supplements the vaginal mucous during intercourse.
- **Perineum:** it is the diamond shaped area medial to the thighs and buttocks in both males and females. It contains the external genitals and anus. A transverse line drawn divides it into two triangles, one **anterior urinogenital triangle** and **posterior anal triangle**.
- **Breasts:** Since breasts are very important for lactation and they undergo several changes as per the menstrual and pregnancy they are also considered as a part of the reproductive system. It is hemispheric projection of variable size lying on the pectoralis major muscles in front of the thorax. They are also present in males but in the rudimentary form. They begin to develop under the influence of estrogen and progesterone hormones. Each breast has a projection the nipple which has a series of openings of lactiferous ducts very closely spaced to each other. This is from where the milk emerges in lactating females. There is a circular area of pigmented skin surrounding the nipple which is called the **areola**. On its surface there are numerous sebaceous glands called the areolar glands. From inside the breast consists of glandular tissue, a mammary glands which is nothing but a modified sweat gland. Its structure is comprised of 15 - 20 lobes spaced from each other by adipose tissue. In each lobe are smaller compartments called lobules composed of grape like clusters of milk secreting called **alveoli**. When milk is produced it passes through a series of secondary tubules and then into mammary ducts. Near the nipple, the mammary ducts expand to form mammary ampullae or lactiferous sinuses where some milk may be stored before draining into lactiferous ducts which carry the milk to the exterior of the body.

Functions: The functions of mammary glands are typically synthesis, secretion and ejection of milk which are collectively called as **lactation**. Lactation is associated with child birth. Milk production is stimulated by the hormone prolactin (produced by anterior lobe of pituitary) with the contribution from progesterone and estrogens. The ejection is stimulated by oxytocin (produced by posterior lobe of the pituitary).

Constituents of Milk: Human milk consists of mainly fat (fat droplets), casein (milk protein), lactose (milk sugar), mineral salts (sodium, calcium, potassium, phosphorus etc.) and a very small amount of vitamins. A normal nursing woman secretes 1-2 litres of milk per day.

TRY IT YOURSELF



1. Endometrium, myometrium and _____ are the three layers of the wall of the uterus. (mesometrium/exometrium/perimetrium)
2. _____ most suitably corresponds to the male penis. (vagina/clitoris/uterus).
3. What is the internal os? Does any entity called external os exist?

4. Gametogenesis

Gametogenesis is a process by which male and female sex cells or gametes i.e. sperms and ova are formed in the male and female gonads namely testis and ovaries, respectively. Since sexual reproduction requires fusion of two haploid gametes to form diploid individual, these haploid gametes are formed through gametogenesis. As there are two morphologically different kinds of gametes and the process of their generation is also different hence they can be studied under two different headings namely Spermatogenesis and Oogenesis.

Spermatogenesis – Formation of sperms

Oogenesis – Formation of ova

4.1 Spermatogenesis

The process of formation starts in the seminiferous tubules of the testes.

In humans the process of spermatogenesis takes about 65 to 75 days. During birth the primordial cells migrate into the testes and become immature germ cells called **spermatogonia** which lie in two or three layers in inner surfaces of seminiferous tubules. The spermatogonia begin to undergo mitosis at puberty and continually proliferate and differentiate through different stages of development to form the sperm

Step 1: Formation of spermatids

- **Multiplication phase:** At sexual maturity, the undifferentiated germ cells divide several times by mitosis to produce a large number of spermatogonia. Spermatogonia (2N) are of two types viz. type A and B resp. Type A spermatogonia form the stem cells which form additional spermatogonia whereas Type B spermatogonia become the precursors of sperms.

- **Growth phase:** Each type B spermatogonium actively grows to a larger primary spermatocyte by obtaining nourishment from the nursing cells (**Sertoli**).
- **Maturation phase:** Each primary spermatocyte undergoes two successive divisions, called **maturation divisions**. The first maturation division is reductional or meiotic. Thus the primary spermatocyte divides into two haploid daughter cells called as **spermatocytes**. Both secondary spermatocytes now undergo second maturation division which is an ordinary mitotic division and form four haploid spermatids. Thus each primary spermatocyte forms four haploid spermatids.

Step 2: Formation of Spermatozoa from spermatids or spermiogenesis

The formation of spermatozoa from spermatids is called **spermiogenesis**. These spermatozoa are later known as sperms. Thus, four sperms are formed from one **spermatogonium**. After spermiogenesis sperm head become embedded into the **cells of Sertoli** later they are finally released from the seminiferous tubules by the process called **spermiation**.

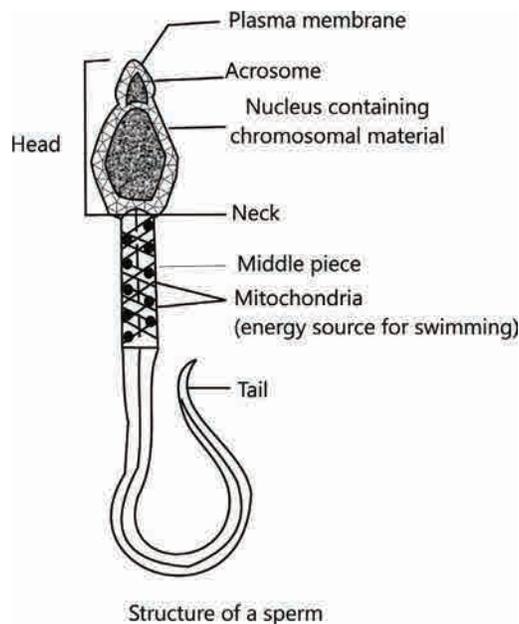


Figure 3.8: Human sperm

Hormonal control of spermatogenesis: The gonadotropin – releasing hormone (GnRH) by the hypothalamus initiates the process of spermatogenesis. GnRH acts on the anterior lobe of pituitary gland to secrete **luteinizing hormone (LH)** and **follicle stimulating hormone (FSH)**. LH acts on the Leydig's cells of the testis to secrete testosterone. FSH acts on the cells of Sertoli to secrete an **androgen binding protein (ABP)** and inhibin. ABP concentrates testosterone in the seminiferous tubules. Inhibin suppresses FSH synthesis. FSH acts on spermatogonia to stimulate sperm production.

Significance of Spermatogenesis:

- During this process one spermatogonium produces four sperms.
- Sperms have exactly half the number of chromosomes so that the diploid chromosome number can be restored after fertilization.

- During meiosis I crossing over takes place which brings about the genetic variation.
- Spermatogenesis occurs in many organisms hence it can be used to establish the phylogenetic link between the organisms.

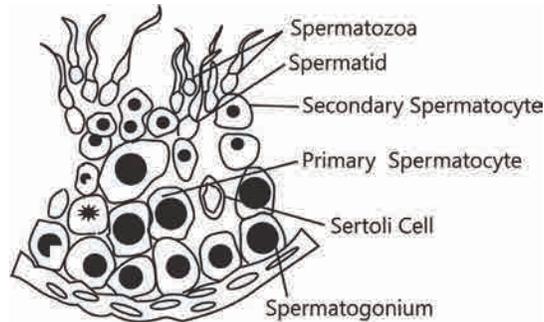


Figure 3.9: Sectional view of a seminiferous tubule

Sperm: Spermatogenesis produces around 300 million sperms daily. Sperms are microscopic, motile cells. They remain alive for about 24 to 48 hrs in the female reproductive tract and up till then they retain their ability to fertilize an ovum which has been released. A typical human sperm is about 60 μm long. It has several structures which are adapted specially for reaching and penetrating the secondary oocyte. The major parts of the sperm are head, neck, middle piece and the tail.

- **Head:** The flattened pointed head of the sperm is 4 - 5 μm long. It has an anterior acrosome a cap like vesicle filled enzymes (mostly hyaluronidases and proteases) that help the sperm to penetrate the secondary oocyte to bring about fertilization and a large nucleus containing highly condensed haploid chromosomes.
- **Neck:** It's a short constricted region behind the head which contains many centrioles. The proximal centriole towards the nucleus which plays a role in the first cleavage of the zygote and the distal centriole which gives rise to the axial filament of the sperm.
- **Middle piece:** The middle piece contains the mitochondria arranged in spiral. They provide the energy in the form of ATP for the movement of the sperm and also for sperm metabolism.
- **Tail:** The tail is made up of two pieces the principal piece or the longest part called also as the axial filament surrounded by a thin layer of cytoplasm. Behind the main piece is the terminal tapering portion called the end piece which is the naked filament alone.

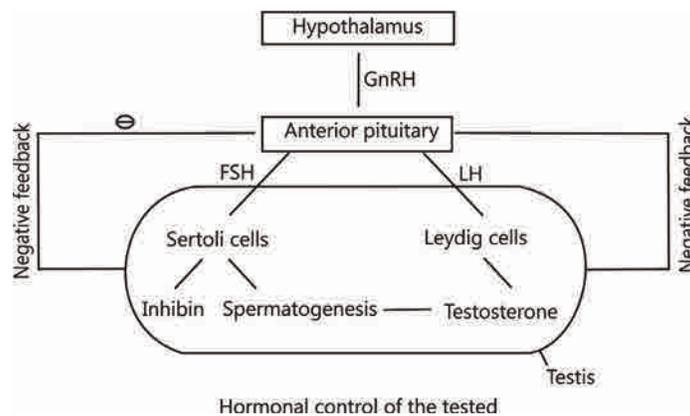


Figure 3.10: Hormonal control of the testes

4.2 Oogenesis

The process of oogenesis starts in the ovaries. Unlike males where spermatogenesis begins at puberty, oogenesis begins in females even before they are born. This also has three phases:

- **Multiplication:** During early fetal development primordial germ cells migrate from the yolk sac to the ovaries. These germ cells differentiate into the ovaries to form oogonia. These cells divide by mitosis, producing a couple of million egg mother cells or oogonia in each ovary of the foetus. No more oogonia are formed or added after birth.
- **Growth phase:** This is a very long phase. It may extend many years. The oogonium grows into a large primary oocytes. Each primary oocyte then gets surrounded by a layer of granulose cells to form primary follicle. A large number of these follicles degenerate during the period from birth to puberty. At puberty only 40,000 or so remain in each ovary.
- **Maturation phase:** Each primary oocyte undergoes two maturation divisions, i.e. the first meiotic and the second meiotic. The results of the maturation divisions in oogenesis are different from those in spermatogenesis. In the first meiotic division the primary oocyte divides into two unequal haploid daughter cells – a large secondary oocyte and very small first polar body also called the polocyte. In the second maturation division, the first polar body may divide to form two second polar bodies and the secondary oocyte again divides into unequal daughter cells, an ootid and a second polar body. The ootid grows into a functional haploid ovum. Thus from one oogonium, one ovum and three polar bodies are formed. The ovum is actual female gamete. The polar bodies soon degenerate and take no part in reproduction.

In human beings, ovum is generally released in the secondary oocyte stage. The maturation of secondary oocyte is completed in the mother's oviduct usually after the sperm has entered the secondary oocyte for fertilization. In humans, the first polar body does not undergo meiosis II, whereas the secondary oocyte proceeds as far as the metaphase stage of meiosis II. However it stops advancing any further, it awaits the arrival of sperm for completing of meiosis II. Entry of sperm restarts the cell cycle breaking down MPF (M-phase promoting factor) and turning on APC (Anaphase promoting complex). Completion of meiosis II converts the secondary oocyte into a fertilized ovum egg or zygote and also a second polar body.

Hormonal Control of Oogenesis

GnRH secreted by the hypothalamus stimulates the anterior lobe of the pituitary gland to secrete LH and FSH. FSH stimulates the growth of Graafian follicles and also the development of the oocyte within the follicle to complete the meiosis I to form secondary oocyte. FSH also stimulates the formation of estrogens. LH induces the rupture of the mature Graafian follicle and thereby the release of secondary oocyte. Thus LH causes ovulation. The remaining part of the Graafian follicle is stimulated by LH to develop into corpus luteum (yellow body). The rising levels of progesterone inhibits the release of GnRH, which in turn inhibits production of FSH, LH and progesterone.

Significance of Oogenesis

- One oogonium produces one ovum and three polar bodies.
- Polar bodies have very small amount of cytoplasm. More cytoplasm is retained in the ovum which is important for the development of the early embryo. Formation of polar bodies maintains half number of

chromosomes in the ovum.

- During meiosis first crossing over takes place which brings that variation.
- Oogenesis occurs in various organisms. Therefore, it supports the evidence of basic relationship among the organisms.

Ovulation

- The release of the ovum from the ovary in the secondary oocyte stage is called ovulation.
- In humans ovulation occurs about 14 days before the onset of next menstruation.
- Ovulation is induced by LH.
- The maturation of the ovum is completed in the mother's fallopian tube usually after the sperm has entered the secondary oocyte during fertilization.

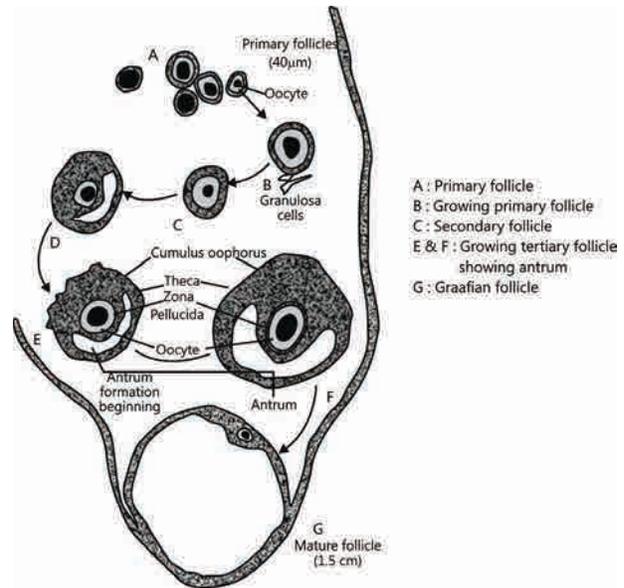


Figure 3.11: Human oocyte development

Ovum

The mature ovum or a female gamete is spherical in shape. The human ovum is said to be alecithal which means almost free of yolk. The cytoplasm is called ooplasm containing large nucleus, termed the germinal vesicle. The nucleus contains a prominent nucleolus. There are no centrioles in the ovum. The cytoplasm is enveloped by the plasma membrane or cell membrane. Very small vesicles called cortical granules are present under the plasma membrane. A narrow perivitelline space is present outside the plasma membrane. Outside the perivitelline space is the thick non-cellular zona pellucida, probably secreted by the follicular cells. Outer to the zona pellucida there is a very thick cellular corona radiata. The latter is formed of radially elongated follicular cells. The side of the ovum which extrudes polar bodies is termed as animal pole. The side exactly opposite to this is called vegetal pole. Human egg loses its ability to be fertilized about 24 hrs after ovulation.

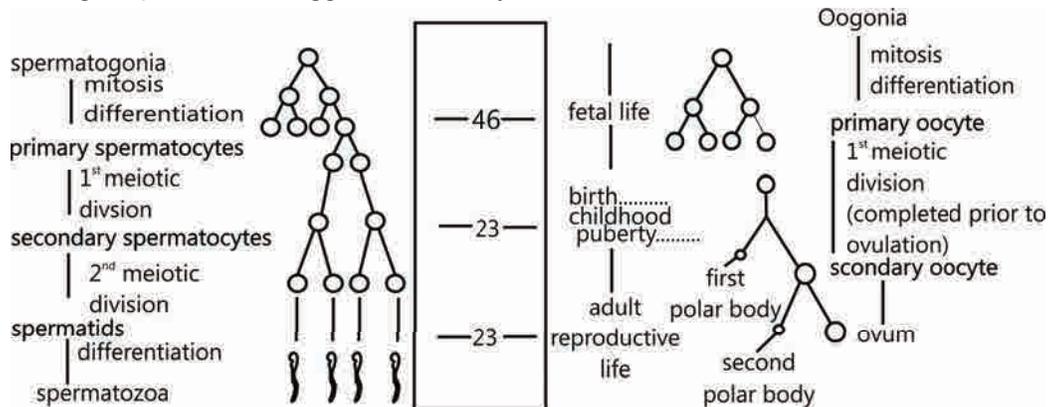


Figure 3.12: Gametogenesis in Humans



TRY IT YOURSELF

1. Write the function of- Sertoli cells, inhibin.
2. Distinguish between spermatogonia and spermatozoa.
3. Write a short note on the role of hormones in oogenesis.

5. Female Reproductive Cycle

The general term female reproductive cycle encompasses the ovarian and uterine cycles and the hormonal changes that regulate them and the related cyclical changes that occur in the breast and the cervix.

Menstrual Cycle:

Menstrual cycle also known as monthly endometrial cycle is a periodic and cyclic changes in the human endometrium which is marked by the periodic shedding of the progesterational endometrium accompanied by blood loss. It occurs in women and higher apes. In humans, menstruation starts from the time puberty is reached. The first menstruation marks the beginning of the menstrual cycle and is called as menarche. This is around 12 - 15 years of age in most of the women. It continues until 45 - 50 years of age or until menopause. This is continuous and regular cycle which is never interrupted unless there is pregnancy or any other serious disorder. The normal human menstrual cycle consists of two segments: The ovarian cycle and the uterine cycle. The ovarian cycle maybe further divided into two stages: i) Follicular stage and ii) Luteal stage whereas the uterine cycle is divided into i) Proliferation of the uterine endometrium ii) Development of the secretory changes in the endometrium and iii) Desquamation or shedding of the endometrium also known as menstruation.

The significant event of this cycle is the menstruation or bleeding from the uterus which lasts for about 4 - 5 days which are also known as menses.

Ovarian Cycle: The ovarian cycle is a series of events in the ovaries that occur during and after maturation of an oocyte. Steroid hormones released by the ovaries control the uterine cycle or the menstrual cycle, which is a concurrent series of changes in the endometrium of the uterus to prepare it for the arrival and development of a fertilized ovum. If fertilization doesn't occur the levels of ovarian hormones decrease which cause the stratum functionalis of the endometrium to slough off.

Gonadotropin releasing hormone (GnRH) secreted by the hypothalamus controls the events of the female reproductive cycle. GnRH stimulates the release of follicle stimulating hormone FSH and luteinizing hormone LH from the anterior pituitary. The released FSH initiates the follicular growth and the secretion of estrogen by growing ovarian follicles. LH stimulates the further development of the follicles and their full secretion of estrogens. At mid-cycle LH triggers ovulation and also promotes the formation of ovulation hence the name Luteinizing hormone. Stimulated by LH the, the corpus luteum produces and secretes estrogens, progesterones, relaxin and inhibin. The duration of the female reproductive cycle generally varies from 24 - 35 days. We assume an average of 28 days for the following discussion.

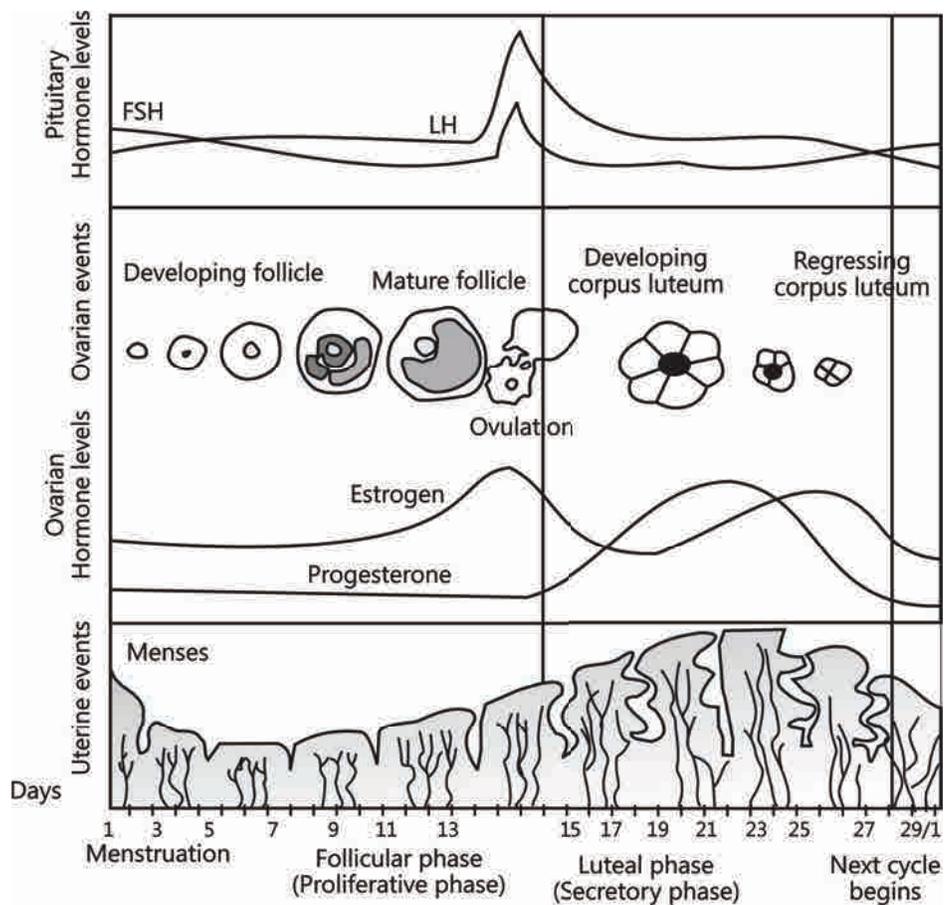


Figure 3.13: Representation of the hormonal regulation in female menstrual cycle

Uterine Cycle:

- **Proliferative phase**

At the beginning of the menstrual cycle most of the endometrium is shed off (also known as desquamation) by menstruation. After menstruation only a thin layer of stroma remains and only epithelial cells left are those left in the deeper layers of the glands or the crypts of the endometrium. The proliferative phase includes around 6 - 13 or 14 in a 28 day cycle. The FSH secreted by the anterior lobe of the pituitary gland stimulates the ovarian follicle to secrete estrogens in large amounts. These estrogens stimulates the endometrial cells to proliferate. The endometrium becomes thicker by rapid cell multiplication. Also there is an increase in number of uterine glands and blood vessels.

- **Ovulatory phase:** At the middle of the cycle i.e. 14 day both FSH and LH reach a peak level. Rapid secretion of LH induces rupturing of Graafian follicle and thereby release of the ovum (in human beings secondary oocyte is released). This event is called **ovulation**. In other words LH causes ovulation.
- **Luteal phase:** The cycle includes the days 15 to 28 in a 28 day cycle. LH secreted by the anterior lobe of the pituitary causes ovulation. The remaining cells of the ovarian follicles are stimulated by the LH to develop into **corpus luteum**. Large amounts of progesterone are secreted by the corpus luteum.

Progesterone stimulates the uterine glands to produce increased amounts of watery mucus. This is also known as secretory phase. During this secretory phase large amounts of watery mucus are also secreted by the vaginal glands and by the glands of the fallopian tubes. Progesterone is essential for maintenance of the endothelium (the inner most lining of the endometrium). Such an endothelium is necessary of implantation of the fertilized ovum and the other events of the pregnancy.

- **Menstrual phase:** In absence of fertilization, the corpus luteum degenerates. The degeneration of corpus luteum causes the endothelium to disintegrate since enough amounts of progesterone are not present to maintain it. This disintegration also leads to menstruation marking a new cycle. Menstruation is also described as the weeping of the uterus for the lost ovum.

The major events in the menstrual cycle are as follows:

- Menstrual phase is caused by the reduction of progesterone and estrogen both.
- Proliferative phase is caused by the increased production of estrogens.
- LH causes ovulation.
- Secretory phase is caused by increasing levels of progesterone.

Menopause

At around 50 years or something the sexual cycle becomes irregular and ovulation fails to occur. After a few months or in some cases a few years the sexual cycle ceases altogether. This period when the sexual cycle ceases and female sex hormones just reduce to almost none is called as the **Menopause**. The causes of the menopause have many theories but the most important reason is the burning out of the ovaries or the reducing numbers of the primordial follicles. Since about only 400 primordial follicles are remaining, at around 45 they are almost over, with only a few remaining. Thus the levels of estrogens produced is also reduced and hence they can no longer inhibit the production of gonadotropins LH and FSH. These gonadotropins are produced in large and continuous quantities but the remaining follicles have already become atretic and hence there is no estrogen produced in the ovaries. The loss of estrogen causes marked physiological changes in the function of the body including hot flushes characterized by extreme flushing of the skin (redness in skin caused by increased blood flow), psychic sensation of dyspnea (labored breathing), irritability, fatigue, anxiety, decreased strength or calcification of bones throughout the body.

Did You Know

At around 40 - 55 years of age men experience a phase with phenomenon similar to the female menopause. This is called as the male andropause. This is caused due to gradually decreasing levels of testosterone in males, it may be urinary and sexual changes and more generalized changes – i) the urinary sexual changes may be reduced sexual desire or libido ii) reduced sexual potency for maintaining erections iii) ejaculation problems iv) reduced fertility v) urinary problems like weak stream, urinary incontinence etc.

6. Fertilization

Definition: The fusion of the haploid male gamete (the sperm) and the haploid female gamete (the ovum) to form a diploid zygote is called **fertilization**.

In human beings fertilization takes place mostly in the ampulla of the oviduct. After insemination (i.e. discharge of semen in the female vagina close to the cervix) the sperms travel all the way up towards the uterus but only a few thousand find their way into the openings of the fallopian tubes. Primarily the contractions of the uterus and the fallopian tubes assist the sperm in movement but later on they move by their own motility. Sperms swim in the fluid medium at the rate of 1.5 to 3 mm per min to reach the site. In the meantime the leucocytes of the vaginal epithelium also engulf millions of the sperms.

Capacitation of sperms: It is the phenomena of physiological maturation of sperms inside the female genital tract. It occurs in the presence of viscous fluid secreted by the secretory cells of the lining of the oviducal mucosa. It takes about 5 - 6 hours. It also involves a variety of other changes:

- Loss of decapacitation factors
- Influx of calcium into the sperms
- Sperm flagellar movements change from undulatory to whiplash type
- Removal of the cholesterol vesicles adhering to the acrosome.

Arrival of the secondary oocyte: The secondary oocyte is released from the mature Graafian follicle on the 14 day of the 28 day cycle and this process is called **ovulation**. The oocyte is received by the fallopian tube through the fallopian funnel which has fimbriae or the finger like processes which has cilia the movements of both together guide the sperm into the fallopian tube. The secondary oocyte can be fertilized only upto 24 hours after being released from the ovary. The secondary oocyte is surrounded by numerous sperms but only one sperm succeeds in fertilizing the oocyte. The second meiotic division is completed by the entry of the sperm into the secondary oocyte. After this secondary oocyte is called the ovum or the egg.

Fertilizin and Antifertilizin reaction: So that number of sperms reduces the ovum secretes a chemical called the fertilizin which has a number of spermophilic sites where sperms can bind by their antifertilizin site. This fertilizin - antifertilizin reaction is highly species specific i.e. only the sperms of a particular species can recognize their binding site on the chemicals which are specific for their species. It is a complete lock and key type of mechanism. This adhesion of the sperms to the egg of the same species is through chemical recognition is called as agglutination, and this reaction is also known as agglutination reaction. The function of this is to avoid chances of polyspermy and thus ensure that only one sperm penetrates the ovum.

Penetration of the sperm: Finally the only sperm reaches the ovum and penetrates it by a series of mechanisms as given below:

Physical and chemical events in fertilization: i) Acrosomal reaction: After ovulation, the secondary oocyte reaches the Fallopian tube. The capacitated sperms undergo a reaction called the acrosomal reaction. They release various chemicals which are contained in the acrosome. These chemicals are together called as the sperm lysins. The important chemicals of the sperms lysins are: a) Hyaluronidase: It acts on the ground substances of follicle cells, b) Corona penetrating enzyme: It dissolves the corona radiata and c) Zona acrosin: It helps dissolve the **zona pellucida**.

The factors which play an important role in this reaction are the optimum pH, Ca^{++} , Mg^{++} ions and concentration and temperature. Ca^{++} especially plays a very important role in the acrosomal reaction, in its absence the reaction does not occur.

- **Effects of the acrosomal reaction:** Due to this reaction the plasma membrane of the sperm fuse with the plasma membrane of the secondary oocyte so that the sperm contents can enter the oocyte. Only the sperm nucleus and middle piece enter the oocyte, the tail is lost. Binding of the sperm and the oocyte induces depolarization of the oocyte plasma membrane. Depolarization prevents polyspermy (entry of more than one sperm into the oocyte ensures monospermy i.e. entry of only a single sperm into the oocyte).
- **Cortical Reaction:** Just after the fusion of sperm and plasma membranes of the oocyte, the ovum shows a cortical reaction which is marked by the development of cortical granules beneath the plasma membrane of the oocyte. These granules fuse with the plasma membrane of the oocyte and release their enzymes known as the **cortical enzymes** between the plasma membrane and the zona pellucida. These enzymes harden the zona pellucida which also prevents entry of additional sperms or polyspermy.
- **Sperm Entry:** At the point of contact with the sperm, the secondary oocyte forms a projection called the **cone of reception** or the **fertilization cone** which receives the sperm. The distal centriole of the sperm divides and forms two centrioles to generate the mitotic spindle formation for cell division, since the mammalian secondary oocyte doesnot have any centrioles of its own.
- **Fusion of Gametic Nuclei or Amphimixis or Karyogamy:** Sperm entry stimulates the secondary oocyte to complete the suspended or paused second meiotic division. This produces a haploid mature ovum and a second polar body. The head of the sperm which contains the nucleus separates from the body and the tail. This head becomes the male pronucleus. The second polar body and the sperm tail degenerate. The nucleus of the ovum is called the female pronucleus. The male and female pronuclei move towards each other. Their nuclear membranes disintegrate and they fuse together. Mixing of the chromosomes of the sperm and the ovum is also known as karyogamy or amphimixis. The fertilized ovum or egg is now called a zygote. The **zygote** is diploid unicellular cell that has 46 chromosomes in humans. The woman is now said to be pregnant.
- **Activation of the egg:** The metabolism in the zygote is stimulated by the entry of the sperm. This causes the rates of cellular respiration and protein synthesis to increase greatly. Besides activating the egg another role of the sperm is also to carry DNA to the egg.
- **Significance of Fertilization:** Fertilization also has the following significances
 - It restores the diploid number of chromosomes, which is an important characteristic of our species i.e. 46 chromosomes.
 - It also initiates cleavage.
 - It introduces the centrioles which are lacking in the ovum, since without the centrioles the spindle fibres can't form.
 - It combines the characters of both the parents. This also introduces variations.
 - The sperm nucleus brings in the Y chromosome which determines the sex of the embryo.

- Fertilization membrane developed after the entry of the sperm prevents the entry of other sperms into the ovum.

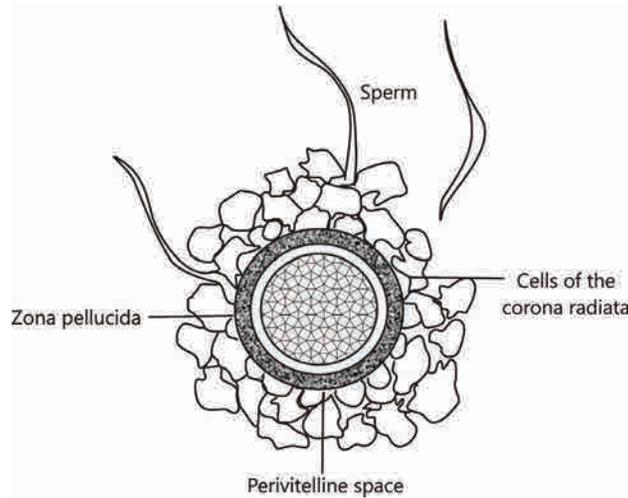


Figure 3.14: Process of fertilization

TRY IT YOURSELF

1. Which is the longest part of the sperm?
2. _____ induces ovulation. (LH/GH)
3. Level of _____ is high during pregnancy. (progesterone/fsh)
4. what are sperm lysins?
5. changes occur in the _____ after one sperm penetrates the ovum. (sertoli cells/ zona pellucida)

7. Embryonic Development upto Blastocyst Formation

Cleavage:

The most important event after fertilization is called cleavage. Cleavage is defined as the series of mitotic divisions of the zygote which converts the single celled **zygote** into a multicellular structure called as **blastula** or **blastocyst**.

Process: After fertilization in about thirty hours, the newly formed zygote divides into two cells, the blastomeres, in the upper portion of the fallopian tube. This division of the zygote into two cells is called as **the first cleavage** (cleavage means cutting into two). This cleavage is meridional (vertical) and along animal-vegetal pole axis. The next division occurs within forty hours after fertilization. This is also meridional but perpendicular to the first one and takes place first in the larger blastomere. And the third division occurs after about three days after fertilization. During these early cleavages, the young embryo is moves slowly

down towards the uterus. At around the fourth day the embryo reaches the uterus. It has 8 -16 blastomeres and this solid mass of cells is called morula or the little mulberry since it looks like a mulberry. It reaches the uterus 72 hours after fertilization that's on the fourth day. It is still surrounded by the zona pellucida. When the blastomeres divide completely the cleavage is said to be holoblastic. Due to unequal cleavage the blastomeres are of two types:

- **Micromeres:** These are peripheral, smaller and transparent.
- **Macromeres:** These are central and larger.

Formation of blastocyst:

It involves the rearrangement of blastomeres. The outer layer of cells become flat and form the trophoblast or the trophoectoderm. This trophoectoderm draws nutritive materials secreted by the uterine endometrial glands. The fluid secreted by the trophoblast collects in a new central cavity called the blastocoel or segmentation cavity or blastocystic vesicle. As the amount of nutritive fluid increases in blastocoel, morula enlarges and takes the form of cyst and is called as the blastocyst or blastodermic vesicle. The cells of the trophoblast never participate in formation of embryo proper. These cells form only protective and nutritive extra- embryonic membranes which later form the fetal part of the placenta e.g. chorion for placenta formation, amnion for protection from injury and desiccation of the embryo. The cells of trophoblast which are in contact with the inner cell mass are called cells of Rauber. Inner mass of cells or macromere form a knob at one side of trophoblast also known as embryonal knob and is primarily determined to form the body of the developing embryo so is called the precursor of the embryo. The embryo also has stem cells which are predetermined to form all types of tissues and organs. The side of the blastocysts to which embryonal knob is attached is called as **embryonic pole** while the opposite side is called as abembryonic pole. Zona pellucida disappears at the time of blastocyst formation.

Characteristics of cleavage

- Cleavage involves a series of mitotic division so that the daughter cells are genetically similar to the parent cells.
- Mitotic divisions continue until the average cell size characteristic to the parent organism is achieved. Number of divisions depend upon the volume of the egg and the typical somatic egg. The resultant cells are called **blastomeres**.
- During cleavage as there is no growth of the cells during the interphase period, the size of the cells becomes smaller and smaller. Hence the cleavage is also called as fractionating process. As the blastomeres do not move the general size, shape and volume remain the same throughout the cleavage.
- The nuclear-cytoplasmic ratio goes on increasing as the cleavage progresses. It is so that the DNA synthesis occurs very rapidly during the cleavage but there is no cytoplasmic synthesis. The cytoplasmic materials are rapidly used in DNA replication.
- Oxygen consumption is also very rapid during cleavage. In the early stages blastomeres show synchronous division but later this synchrony is lost. The pattern and speed of cleavage is mostly decided by the cytoplasm and not the nucleus. The yolk tends to suppress the cleavage.

8. Implantation

Definition: The process of attachment of the blastocyst on the endometrium of the uterus is called as **implantation**.

It may occur anywhere from 6th and 10th day after fertilization but generally it occurs at 7th day after fertilization. About 8 days after fertilization the trophoblast develops in two layers in the region of contact between the blastocyst and endometrium. These layers are a) syncytiotrophoblast which contains non-distinct cell boundaries and b) cytotrophoblast between the inner cell mass and syncytiotrophoblast that is composed of distinct cells. The portion of the blastocyst where the inner cell mass is located lies against the endometrium of the uterus. The blastocyst sinks into a pit or depression formed in the endometrium and gets completely buried in the endometrium. This embedded blastocyst forms villi (finger like projections) to get nourishment and to get fixed in the endometrium. Implantation causes nutrient enrichment, enlargement of cells and formation of the decidua. The decidua is the uterine part of the **placenta**.

The role of Human Chorionic Gonadotropin (HCG): The trophoblastic cells secrete human chorionic gonadotropin hormone which has properties similar to LH from the pituitary gland. In pregnancy however HCG takes over from LH. The HCG maintains the corpus luteum and stimulates it to secrete progesterone. This progesterone maintains the endometrium of the uterus and causes it grow throughout pregnancy. This also prevents menstruation. Progesterone also causes the cervix to secrete mucus which forms a protective plug during pregnancy in the cervix.

Thus implantation leads to pregnancy. If HCG is found in a woman's urine then it indicates her pregnant status.

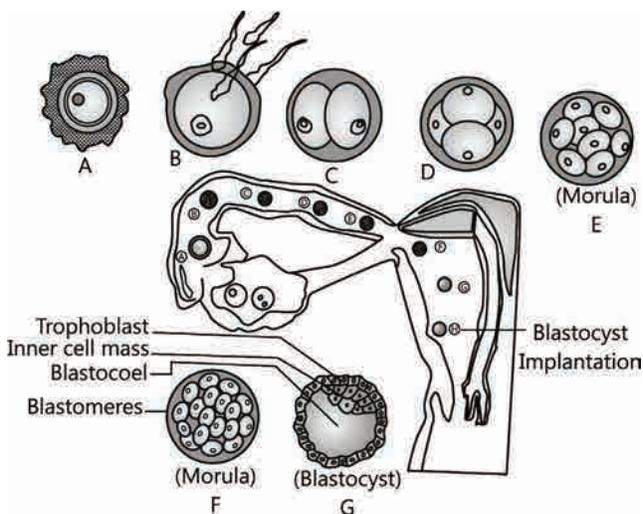


Figure 3.15: Diagram showing implantation of blastocyst in human uterus

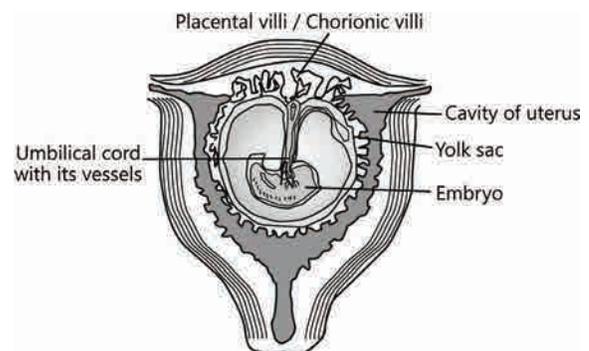


Figure 3.16: An embryo developing into a Fetus



KNOWLEDGE BUILDER

Difference between embryo and foetus

- Embryo is an organism in the early stages of development. In human beings the development organism from conception to approximately the eight week is called as the embryo (i.e. second month of pregnancy).
- Foetus is the unborn young one after it has taken form in the uterus. In human beings, an embryo is called a foetus from eight week onwards till the birth.

9. Gastrulation

Gastrulation is the movement of cells in small sheets or masses so as to get primary germinal layers. There are three primary germinal layers: a) endoderm b) ectoderm and c) mesoderm.

The cell movements that occur during gastrulation are called morphogenetic movements since they lead to initiation of morphogenesis and the product of gastrulation is called gastrula.

Formation of primary germinal layers:

- The cells of the inner cell mass also differentiate into two layers: a) a layer of small, cuboidal cells known as the **hypoblast layer**, b) a layer of columnar cells, the epiblast layer. Both the hypoblast and the epiblast layer form a flat disc called the embryonic disc.
- Gastrulation begins with the formation of primitive streak on the surface of the epiblast.
- The first cells to move inward displace the hypoblast to create a definitive endoderm.
- Once the definitive endoderm is established, inwardly moving epiblast forms the mesoderm.
- Cells remaining in the epiblast form the ectoderm. Thus epiblast is the source of all the cells in the embryo.

Placenta:

Definition: The **chorionic villi** (finger like projections on the surface of the trophoblast) and the uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (fetus) and maternal body is called **placenta**.

Because chorion takes part in the formation of the placenta, the human placenta is also called chorionic placenta. It consists of two parts: **the fetal part** – the chorion and **the maternal part** – the decidua basalis. The fetal part of placenta grows into the uterine mucosa with its chorionic villi. The degree of intimacy is so strong that the blood vessels of the chorionic villi are bathed in the mother's blood. This type of placenta which is based on the intimacy between fetal and maternal parts of the placenta, is referred to as hemochorial placenta. The placenta is connected to embryo through an umbilical cord which helps in the transport of substances to and from the embryo.

The placenta performs the following functions:

- **Nutrition** – The placenta functions as the passage for passing the nutritive elements from the maternal blood to the foetus.
- **Respiration** – Oxygen is carried from maternal blood to the fetal blood through placenta and carbon dioxide is carried exactly in the opposite direction i.e. from foetus to maternal blood.
- **Excretion** – The fetal excretory products diffuse into the maternal blood through placenta and are excreted by the mother.
- **Storage** – Placenta stores glycogen, fat etc.
- **As a barrier** – Placenta serves as an efficient barrier and allows those materials to pass into fetal blood that are necessary.
- **Endocrine function** – Placenta secretes some hormones such as estrogens, progesterone, human chorionic gonadotropins HCG's and human chorionic somatomammotropin HCS's (it was formerly known as human placental lactogen HPL), chorionic thyrotropin, chorionic corticotropin and relaxin.

The HCS's stimulates the growth of mammary glands during pregnancy. Relaxin facilitates parturition (act of birth) by softening the connective tissue of the pubic symphysis.

10. Parturition

The duration of pregnancy in human beings is about 9 months \pm 7 days. This period is called as gestational period. In other words the gestational period is the time from conception till the birth. At the end of the pregnancy term, vigorous contraction of uterus cause the expulsion of the foetus from the body. This act of expelling the young one after completion of full term of gestational period is called as parturition.

The mechanism of parturition is induced by both nervous system and hormones secreted by the endocrine glands of the mother. The signals for child birth (parturition) originate from the fully matured foetus and placenta which induce mild uterine contractions called fetal ejection reflex.

This reflex causes oxytocin to be released from the posterior lobe of the pituitary gland. The amount of oxytocin is increased just before and during labor pains (pains of child birth). Oxytocin promotes contractions of the uterine muscles which produce a long series of involuntary contractions of the uterus. Relaxin increases the flexibility of the pubic symphysis and the ligaments of the sacroiliac and sacrococcygeal joints and helps dilate the uterine cervix of the baby. Both these actions give way to the smooth passage of the foetus during childbirth.

Stages of childbirth:

- **Stage of dilation:** The onset of labor pain to complete dilation of the cervix is called the stage of dilation. This stage lasts 6 - 12 hours. During this stage there are events like the regular contraction of the uterus, rupturing of the amniotic sac and the complete dilation of the cervix occur. The first effect of the pains is the opening of the cervix. The amniotic fluid starts flowing out through the vagina.
- **Stage of expulsion:** The time from the complete dilation of the cervix to the delivery of the baby is called the stage of expulsion. It lasts from about 10 mins to several hours. The baby passes through the cervix and the vagina and is born or delivered.

- **Placental Stage:** After the delivery of the child, powerful contractions of uterus expel the placenta from the uterus along with the umbilical cord. This is also known as after birth. These contraction also constrict blood vessels that were torn during the delivery and hence prevent hemorrhage. It takes about 28 to 35 days for the uterus to return back to its non- pregnant stage by reduction in size and restoration of the endometrium of the uterus.



Did You Know

Labor pains are the highest intensity of pains ever tolerable to human beings. It is said to be a pain which can be compared to the breaking of all the bones in the body at once or even to the pain of end stage cancer patients. Still the women survive this pain and give birth to the child.

11. Lactation

Definition: The mammary glands of the female undergo differentiation during pregnancy and start producing milk towards the end of pregnancy, this process is called lactation.

Hormonal regulation of lactation: Around puberty the mammary glands begin developing in human females under the influence of estrogen and progesterone. Secretion and storage of milk generally begins after the birth of a young one, usually within 24 hours under the influence of hormone prolactin - PRL secreted by the anterior lobe of the pituitary gland.

The ejection of milk is however stimulated by the hormone oxytocin situated by the posterior lobe of the pituitary gland.

Colostrum: The milk secretion for the first few days just after child birth is called as colostrum.

This is yellowish fluid that contains cells from the alveoli and is rich in protein (lactalbumin and lactoprotein) but low in fat. Colostrum contain antibodies and help in building up the immunity of the new born infant.

Composition of milk: Human milk contains water and organic and inorganic substances. Its main constituents are fat droplets, casein, lactose, mineral salts, and small quantity of vitamins. It is poor in iron content. Vitamin C is present in small quantity in milk. The process of secretion is regulated by the nervous system. The process of milk secretion is influenced by hormones of the pituitary as well as the other endocrine glands. There is contribution by the psychic state of the woman. A nursing woman produces about 1 to 2 litres of milk per day.

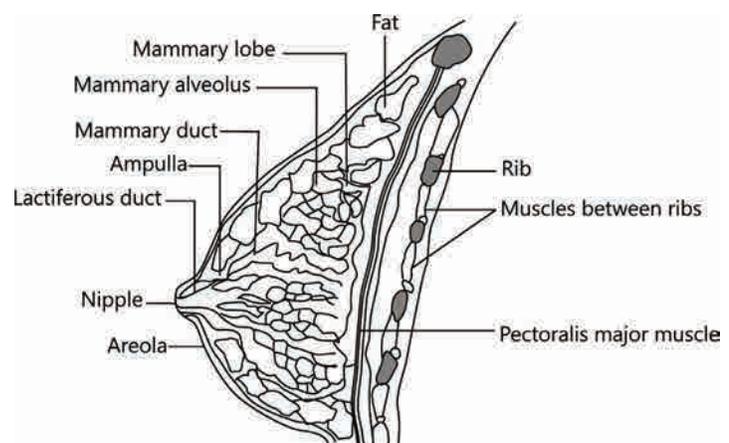


Figure 3.17: Sectional view of a mammary gland

**TRY IT YOURSELF**

1. What is colostrum?
2. What is decidua?
3. Write about the role of HCG
4. Write about the role of oxytocin.

Summary

- Humans are sexually reproducing and viviparous organisms.
- The male reproductive system comprises of a pair of testes, the male sex accessory ducts, the accessory glands and external genitalia (the penis).
- Each testis has about 250 compartments called testicular lobules
- 1 to 3 seminiferous tubules are present in each lobule.
- Seminiferous tubules are lined by spermatogonia and Sertoli cells on the inside.
- The spermatogonia undergo meiotic divisions leading to spermatogenesis.
- Sertoli cells provide nutrition to the dividing germ cells.
- Androgens are synthesized by the Leydig cells
- The female reproductive system consists of a pair of ovaries, a pair of oviducts, a uterus, a vagina, and a pair of mammary glands.
- The ovum (female gamete) and steroid hormones are produced by the ovaries.
- The uterus has three layers namely perimetrium, myometrium and endometrium.
- Mons pubis, labia majora, labia minora, hymen and clitoris are the female external genitalia.
- The mammary glands (located in the breasts) are one of the female secondary sexual characteristics.
- The reproductive cycle of female primates is called menstrual cycle.
- Usually one ovum is released per menstrual cycle.
- After entry into the female reproductive system, sperms are transported to the junction of the isthmus and ampulla, where the sperm may fertilize the ovum (if present) leading to formation of a diploid cell called zygote.
- The zygote divided and form a blastocyst, which is implanted in the uterus.
- After 8 weeks an embryo may be called a fetus.
- Parturition is the process of childbirth.
- Cortisol, estrogens and oxytocin are some of the hormones involved in parturition.
- Mammary glands secrete milk after child-birth. This process is called lactation.

EXERCISE**Objective Questions**

Q.1 Which represents Mullerian duct in male rabbit

- (A) Prostatic utricle (B) Seminal vesicle
(C) Cowper's gland (D) Urethra

Q.2 Testes are permanently retained in abdominal cavity in

- (A) Elephant (B) Whale
(C) Armadillo (D) All the above

Q.3 Temp. of scrotum as compared to abdominal cavity is less by

- (A) 1°C (B) 5°C (C) 3°C (D) 10°C

Q.4 Outer coat of seminiferous tubules is composed of fibrous connective tissue called

- (A) Tunica propria (B) Lamina propria
(C) Plica semilunaris (D) Tunica albuginea

Q.5 Vasa deferens is cut for

- (A) Female sterilization (B) Male sterilization
(C) Both of the above (D) Temporary sterilization

Q.6 At the time of sexual excitation, muscles in penis

- (A) Relaxed (B) Contracted (C) Collapsed (D) None

Q.7 Which acid occurs in semen

- (A) Citric acid (B) Malic acid
(C) Oxalo acetic acid (D) Succinic acid

Q.8 If testes of a male rabbit are not transferred from abdominal cavity to testes sac then

- (A) Rabbit dies
(B) Absence of male characters
(C) Development of male reproductive system will not occur
(D) Sperms will not form

Q.9 Function of seminal fluid is

- (A) Sexual attraction
- (B) To provide stability to egg
- (C) To provide a medium for movement of sperms
- (D) To provide acidic medium

Q.10 Vasa-efferentia connect the

- (A) Testes with epididymis
- (B) Kidneys with cloaca
- (C) Testes with urinogenital duct
- (D) None

Q.11 In mammals, failure of testes to descend into scrotum is known as

- (A) Paedogenesis
- (B) Castration
- (C) Cryptorchidism
- (D) Impotency

Q.12 Partitions of testis develop from

- (A) Tunica albuginea
- (B) Tunica vasculosa
- (C) Tunica vaginalis
- (D) Rete testis

Q.13 Vasa-efferentia posses

- (A) Peristalsis
- (B) Secretory cells
- (C) Ciliated cells
- (D) Opening for seminal vesicle

Q.14 Vas-deferens arises from

- (A) Cauda-epididymis
- (B) Caput epididymis
- (C) Corpus – epididymis
- (D) Rete testis

Q.15 Common duct formed by union of vas-deferens and duct from seminal vesicle is

- (A) Urethra
- (B) Tunica-vasculosa
- (C) Ejaculatory duct
- (D) Spermatic duct

Q.16 Mesorchium is peritoneal covering of

- (A) Ovary
- (B) Testis
- (C) Kidney
- (D) Liver

Q.17 Scrotum communicates with abdominal cavity through

- (A) Urethra (B) Inguinal canal
(C) Vas-deferens (D) Epididymis

Q.18 Tunica albuginea is the covering around

- (A) Oviduct (B) Testis (C) Kidney (D) Heart

Q.19 The functional unit of testis of man is

- (A) Uriniferous tubules (B) Malpighian tubules
(C) Seminiferous tubules (D) Acini or lobules

Q.20 Testosterone is secreted by

- (A) Leydig's cells (B) Sertoli cells
(C) Pituitary (D) Testis

Q.21 Penile urethra traverses through

- (A) Corpora cavernosa (B) Corpus spongiosum
(C) Corpus collosum (D) Corpus striatum

Q.22 Seminiferous tubules are composed of

- (A) Spermatogonia (B) Glandular epithelium
(C) Sensory epithelium (D) Germinal epithelium

Q.23 In mammals, the testes are located in

- (A) Abdominal cavity (B) Thoracic cavity
(C) Extra-abdominal cavity (D) Pericardial cavity

Q.24 Sustentacular cells are found in

- (A) Testis of mammal (B) Ovary of mammal
(C) Testis of Ascaris (D) Pancreas of frog

Q.25 Bundles of muscles in penis are

- (A) Corpus cavernosa (B) Corpus spongiosum
(C) Both (A) and (B) (D) None of these

Q.26 Glans penis is covered by

- (A) Areomembrana
- (B) Prepuce
- (C) Metrium
- (D) None

Q.27 Greater development of sperms in rabbit takes place in

- (A) Testes
- (B) Vasa-efferentia
- (C) Epididymis
- (D) Spermatic cord

Q.28 Scrotal sacs of man and rabbit are connected with the abdominal cavity by

- (A) Inguinal canal
- (B) Haversian canal
- (C) Vagina cavity
- (D) Spermatic canal

Q.29 In mammals, the testes occur in scrotal sacs, outside the viscera because of the

- (A) Presence of urinary bladder
- (B) Presence of rectum
- (C) Long vas-deferens
- (D) Requirement of low temperature for spermatogenesis

Q.30 Sertoli cells are found in

- (A) Testis of cockroach
- (B) Liver of mammals
- (C) Testis of mammals
- (D) Testis of frog

Q.31 Seminal vesicle is present at the junction of

- (A) Prostate and urethra
- (B) Prostate and vas-deferens
- (C) Prostate and Cowper's gland
- (D) Vas-deferens and testis

Q.32 Seminal plasma has sperms and secretions of

- (A) Prostate, Cowper's & Bartholin glands
- (B) Seminal vesicle, Prostate & Cowper's glands
- (C) Seminal vesicle , ureter & Prostate gland
- (D) Follicles, ureters and prostate gland

Q.33 If the epididymis is not presented then what will happen

- (A) Sperm life cycle is short
- (B) Early cross the pathway
- (C) Functional maturation is early
- (D) Sperm will be incapable for fertilization

Q.34 In majority of pre mature babies testis is situated in

- (A) Scrotal sac
- (B) Abdominal cavity
- (C) Descending pathway
- (D) Come into scrotal sac but not attached properly

Q.35 After vasectomy what happens

- (A) Absence of semen
- (B) Sperm are dead or inactive
- (C) Sperm immediately disappear in semen
- (D) Sperm gradually disappear in semen

Q.36 Sertoli cells occur in

- (A) Human testis
- (B) Frog testis
- (C) Human ovary
- (D) Frog ovary

Q.37 In aged person inguinal canal becomes loose, and some part of intestine is pushed into scrotal sac, the disease is called

- (A) Myctlophia
- (B) Hernia
- (C) Achondroplasia
- (D) None

Q.38 Leydig cells are found in

- (A) Seminiferous tubules
- (B) Testis
- (C) Ovary
- (D) Epididymis

Q.39 Testosterone is secreted by

- (A) Sertoli cells
- (B) Sustentacular cells
- (C) Leydig cell or interstitial cells
- (D) Both (A) and (B)

Q.40 Which of the following is not the part of intratesticular genital duct system?

- (A) Rete testis
- (B) Tubuli recti
- (C) Vas deferens
- (D) Vas efferens

Q.41 Secretions from which one of the following are rich in fructose, calcium and some enzymes?

- (A) Salivary glands
- (B) Female accessory glands
- (C) Male accessory glands
- (D) Liver

Q.42 Which is unpaired gland in male reproductive system of human?

- (A) Bartholin gland
- (B) Seminal vesicle
- (C) Prostate gland
- (D) Cowper's gland

Q.43 A gland associated with the male reproductive organs of mammals is?

- (A) Phallic gland
- (B) Prostate gland
- (C) Bartholin gland
- (D) Mushroom gland

Q.44 Glans penis is formed by

- (A) Corpus spongiosum only
- (B) Corpus cavernosa only
- (C) Corpus spongium & corpus cavernosa both
- (D) Corpus spongiosum forms major part & minor part is formed by corpus cavernosa

Q.45 Which is not correct about sustentacular cells

- (A) It is situated in between the germinal epithelial cells
- (B) It is related with nutrition of sperm
- (C) It forms blood testis barrier
- (D) It forms testosterone from oestrogen

Q.46 What is the oligospermia condition

- (A) If sperm count is 40 to 120 million / ml
- (B) If sperm count is <20 million/ml
- (C) If sperm count is <60million /Ejaculation
- (D) If sperm count is 20 million to 40 million/ ml

Q.47 Circumcision is the procedure of

- (A) Cutting the glans penis
- (B) Removal of whole skin of penis
- (C) Removal of movable skin (prepuce) of glans penis
- (D) Reduce the body part of penis

Q.48 An accessory genital gland is?

- (A) Seminal vesicle
- (B) Cowper's gland
- (C) Prostate gland
- (D) All of the above

Q.49 Vaginal cavity of tunica vaginalis is found in

- (A) Ovaries of female
- (B) Testis of male
- (C) Vagina of female
- (D) None of these

Q.50 Meaning of oligospermia is

- (A) Eggs are fertilized in less number
- (B) Less number of sperms in semen
- (C) More number of sperms formed
- (D) Inactive sperm are formed

Q.51 Sperms and ova are

- (A) Ectodermal in origin
- (B) Mesodermal in origin
- (C) Endodermal in origin
- (D) All of the above

Q.52 If Cowper's gland is removed which of the following will be affected

- (A) Sexual attraction
- (B) Fertilization
- (C) Hardness of penis
- (D) Copulation

Q.53 Capacitation of sperm is provided by

- (A) Urethra
- (B) Vas deferens
- (C) Vagina
- (D) Seminal vesicle

Q.54 Vagina of the female reproductive system is

- (A) Primary sex organs
- (B) Essential sex organs
- (C) Secondary sex organs
- (D) None of these

Q.65 Which is not a secondary sex organs

- (A) Vagina (B) Penis (C) Prostate (D) Mammary gland

Q.66 What is the arborvitae uteri?

- (A) Inner most layer of uterus (B) White matter of cerebellum
(C) Mucosal fold of cervix (D) Wall of vagina

Q.67 Which of the following is not related to vulva?

- (A) Mons-veneris (B) Clitoris (C) Related perineum (D) Epididymis

Q.68 Arborvitae are located at

- (A) Body part of uterus (B) Cylindrical part of uterus
(C) Fundus part of uterus (D) Vagina

Q.69 Germ hill is present in

- (A) Sperm (B) Ovum (C) Graafian follicle (D) All of these

Q.70 Clupein protein occurs in

- (A) Human sperms (B) Avian sperms
(C) Human ova (D) All of the above

Q.71 Which of the following releases inhibin to control spermatogenesis?

- (A) Rete testis (B) Follicular cells
(C) Leydig's cells (D) Sustentacular cells

Q.72 Spermatogenesis process occur in

- (A) Rete testis (B) Seminiferous Tubules
(C) Septula testis (D) Mediastenum testis

Q.73 Which cell inclusion of the spermatid forms the acrosome of the sperm

- (A) Centriole (B) Golgi body
(C) Mitochondria (D) Nucleus

Q.74 Which of the following part of spermatozoon arises from centriole

- (A) Apical cap (B) Head (C) Middle piece (D) Tail

Q.75 Which piece of a sperm is called power house

- (A) Head piece (B) Neck piece (C) Middle piece (D) Tail piece

Q.76 The sperm producing substance of enzymatic nature of sperm lysine. In mammals it is called

- (A) Hyaluronidase (B) Hyaluronic acid (C) Androgamone (D) Gyanogamone

Q.77 The human sperm was first discovered by

- (A) Von Baer (B) Leeuwenhoek (C) Robert hook (D) Darwin

Q.78 "Spermiogenesis" is a process in which

- (A) Spermatids change into spermatozoa
(B) Spermatogonia produce a spermatid
(C) Spermatocytes give rise to spermatozoa
(D) Dormant spermatozoa become active just before ejaculation

Q.79 In gameto genesis, reduction division take place during

- (A) Multiplication phase (B) Growth phase
(C) First maturation division (D) Second maturation

Q.80 Which types of division take place during second maturation division

- (A) Reduction division (B) Equational division
(C) Amitosis (D) None of these

Q.81 Mammals sperm head is

- (A) Spherical (B) Spiral (C) Spoon like (D) Hook like

Q.82 Which part of sperm enters in egg in human

- (A) Complete sperm (B) Only head
(C) Only head and middle piece (D) Heat+ acrosome

Q.83 Release of sperm from testes is called

- (A) Spermiation (B) Semination (C) Insemination (D) Ejaculation

Q.84 Space between acrosome and nucleus is called

- (A) Nebenkern (B) Perforatorium
(C) Nucleus of Pander (D) Perivitelline space

Q.85 Longest phase of spermatogenesis is

- (A) Multiplication phase (B) Growth phase
(C) Maturation phase (D) Germinal phase

Q.86 Correct order of spermatogenesis is

- (A) Spermatocytes, Spermatogonia, Spermatid, Sperm
(B) Spermatogonia Spermatid Spermatocytes, Sperm
(C) Spermatid Spermatogonia Spermatocytes Sperm
(D) Spermatogonia, Primary Spermatocytes, Sec. Spermatocytes, Spermatid, Sperm

Q.87 Hyaluronic acid which binds corona radiate cells is a

- (A) Homo polysaccharide (B) Amino acid
(C) Mucopolysaccharide (D) Glycol protein

Q.88 During spermatogenesis how many spermatozoa are formed from a single primary spermatocyte

- (A) 1 (B) 2 (C) 4 (D) 8

Q.89 How many secondary spermatocyte will form 400 spermatozoa

- (A) 100 (B) 400 (C) 40 (D) 200

Q.90 Normally in the head of a mature sperm cytoplasm is

- (A) Present in large amount
(B) Present in very moderate amount
(C) Present in very little amount
(D) Absent

Q.91 The cells of germinal epithelium which give rise to spermatozoa are called

- (A) Sperms mother cells (B) Primordial germ cells
(C) Spermatocytes (D) Spermatogonia

Q.92 Acrosome and it's membrane is called

- (A) Nebenkern (B) Galea capatis
(C) Germinal vesicle (D) Menchate

Q.93 The acrosome plays a role in

- (A) Fusion of nuclei of gametes
(B) Motility of sperm
(C) Penetration of sperm in to ovum
(D) All of the above

Q.94 Smallest sperm occurs in

- (A) Rabbit (B) Crocodiles (C) Balanoglossus (D) Ascaris

Q.95 Acrosome formation in spermatogenesis occurs in which stage

- (A) First meiotic division (B) Second meiotic division
(C) Growth phase (D) Spermiogenesis

Q.96 In which of the following animals the sperm can survive for a longer period in the body of female

- (A) Mammals (B) Aves (C) Reptiles (D) Amphibian

Q.97 The head of a mature sperm is mainly composed of

- (A) Elongated nucleus and acrosomal material
(B) Mitochondria, cytoplasm & nucleus
(C) Two centriole & the axial filament
(D) All of the above

Q.98 Thin cytoplasmic layer is present in middle part of sperm is called

- (A) Nebenkern (B) Machete (C) Axial filament (D) Zensen ring

Q.99 At the time of birth, ovum is the form of

- (A) Oogonia (B) Primary oocyte (C) Sec. oocytes (D) Egg

Q.100 An egg of bird was coated with varnish and then incubated. The egg did not hatch because the developing embryo

- (A) Could not excrete and died
(B) Could not utilize yolk in the pressure of excess amount of nitrogenous wastes
(C) Died because of depleted O₂ supply
(D) Died because of toxic effect of varnish

Q.101 A human female has the maximum number of primary oocytes in her ovaries

- (A) At menopause (B) At Puberty
(C) At Birth (D) Early in her fertile years

Q.102 Eggs liberated from ovary in human in

- (A) Secondary oocyte stage (B) Primary oocyte stage
(C) Oogonial stage (D) Mature ovum stage

Q.103 Based on distribution of yolk, the egg of from is

- (A) Telolecithal (B) Centrolecithal (C) Microlecithal (D) Alecithal

Q.104 Mammalian eggs have

- (A) No yolk at all (B) Small amount of yolk
(C) Large amount of yolk (D) Large amount of yolk concentrated at one pole

Q.105 Cleidoci egg found in

- (A) Birds (B) Reptiles (C) Insects (D) All the above

Q.106 First meiotic division during Oogenesis occurs in

- (A) First polar body (B) Second polar body
(C) Primary oocytes (D) Secondary polar body

Q.107 Human egg are

- (A) Microlecithal (B) Alecithal (C) Macrolecithal (D) Mesolecithal

Q.108 The minute cells which separate from the developing ova during their maturation are called

- (A) Primary Oogonia (B) Secondary Oogonia
(C) Polar bodies (D) Primary spermatogonia

Q.109 The egg of cockroach is

- (A) Isolecithal (B) Telolecithal (C) Microlecithal (D) Centrolecithal

Q.110 Which of the following is haploid

- (A) Primary spermatocytes & primary Oocytes
(B) Secondary spermatocytes & sec. oocytes
(C) Spermatogonia and Oogonia
(D) Germinal cells

Q.111 "Oligolecithal" egg are these which have

- (A) No yolk (B) Small yolk (C) More yolk (D) Moderate yolk

Q.112 Haploid number of chromosomes are found in

- (A) Zygote (B) Amoeba (C) Queen honeybee (D) Ovum

Q.113 How many sperm and ova will be formed from 50 secondary oocytes and 50 secondary spermatocytes frog

- (A) 50 ova & 200 sperm (B) 50 ova & 100 sperm
(C) 100 ova & 200 sperm (D) 100 ova & 400 sperm

Q.114 Isolecithal eggs are found in

- (A) Birds (B) Frogs (C) Insects (D) Humans

Q.115 The eggs of birds is called

- (A) Polylecithal (B) Megalecithal (C) Macrolecithal (D) All of the above

Q.124 Which of the following is diploid

- (A) Secondary spermatocytes
- (B) Spermatozoa & ova
- (C) Spermatogonia, Oogonia, Primary spermatocyte
- (D) Secondary oocytes

Q.125 Which structure show first meiosis division

- (A) Oogonia & spermatogonia
- (B) Secondary spermatocyte & Sec. Oocyte
- (C) Primary spermatocyte & primary oocytes
- (D) None of the above

Q.126 Stored food of oocytes is

- (A) Nucleus
- (B) Cytoplasm
- (C) Cortical granules
- (D) Yolk

Q.127 Megalecithal egg are found in

- (A) Reptiles, & birds
- (B) Tunicates, Amphibia, monotremes
- (C) Annelida, echinoderm, coelentrata
- (D) Sponge, reptiles, monotremes

Q.128 "Homo lecithal" egg are found in

- (A) Petromyzon, tunicates & chondrichythes
- (B) Amphioxus, fish & amphibian
- (C) Amphioxus, tunicates & mammals
- (D) Birds, Reptiles & monotremes

Q.129 The process of yolk synthesis is called

- (A) Lipogenesis
- (B) Glycogenesis
- (C) Vitellogenesis
- (D) Oogenesis

Q.130 The process of gametogenesis is the formation of

- (A) Sperm
- (B) Ova
- (C) Haploid gamete
- (D) Diploid gamete

Q.131 Butterflies, moth & honey bees & beetle lay eggs of which type

- (A) Microlecithal
- (B) Mesolecithal
- (C) Telolecithal
- (D) Centrolecithal

Q.132 Antrum is filled with fluid and is found in

- (A) Bone-marrow of bone
- (B) Cavity of brain
- (C) Graafian follicle of ovary
- (D) Pericardium of heart

Q.133 One of the following is fibrous layer of follicle

- (A) Theca externa (B) Zona pellucid
(C) Membrane granulosa (D) Vitelline membrane

Q.134 In a 30 year old lady, eggs are released in form os

- (A) Oogonia (B) Primary oocyte (C) Secondary oocyte (D) Atretic follicle

Q.135 Lutein cells are found in

- (A) Primary follicle (B) Corpus albicans (C) Corpus luteum (D) All

Q.136 Process by which Graafian follicle are formed in the ovary is knows as

- (A) Oogenesis (B) Luteirisation (C) Folliculogenesis (D) All

Q.137 Mammalian follicle was first described by

- (A) Leeuwenhoek (B) R. D. Graaf (C) Spallanzini (D) Von Baer

Q.138 for ovulation in reflex ovulation

- (A) Coitus in necessary (B) Coitus is not necessary
(C) Plenty of food is necessary (D) None

Q.139 First menstrual cycle starts at

- (A) Parturition (B) Menopause (C) Puberty (D) Implantation

Q.140 Menstrual cycle is generally of

- (A) 21 days (B) 28 days (C) 39 days (D) 40 days

Q.141 In menstrual cycle ovum is released during

- (A) Beginning (B) Midway (C) End (D) Any time

Q.142 Menstrual cycle is controlled by

- (A) Estrogen and progesterone of ovary (B) FSH and LH of pituitary
(C) Both A and B (D) FSH of pituitary

Q.143 Stages in menstrual cycle are

- (A) Recovery and proliferative phase
- (B) Proliferative and secretory phase
- (C) Proliferative, secretory and menstrual phase
- (D) Recovery phase, secretory phase and phase of menstrual flow

Q.144 Luteal phase is the other name of

- (A) Follicular phase
- (B) Proliferative phase
- (C) Menstrual flow phase
- (D) Secretory phase

Q.145 Follicular phase of menstrual cycle is the other name of

- (A) Proliferative phase
- (B) Secretory phase
- (C) Luteal phase
- (D) Menstruation

Q.146 If the menstrual cycle is of 35 days then what is risk period (cycle start on 1st day)

- (A) 9th to 17th days
- (B) 11th to 18th days
- (C) 16th to 24th days
- (D) 18th to 35th days

Q.147 The process of releasing the ripe female gamete from the ovary is called?

- (A) Ovulation
- (B) Parturition
- (C) Implantation
- (D) Fertilization

Q.148 Ovulation hormone is

- (A) FSH
- (B) ICSH
- (C) LH
- (D) Testosterone

Q.149 If menstrual cycle is 30 days & bleeding start on 1st day then ovulation occur in

- (A) 14th day
- (B) 18th day
- (C) 30th day
- (D) 16th day

Q.150 If mammalian ovum fails to get fertilized, which one of the following is unlikely in this cycle

- (A) Estrogen secretion further decreases
- (B) Progesterone secretion rapidly declines
- (C) Corpus luteum will disintegrate
- (D) Primary follicle starts developing

Q.151 Pregnancy hormone is

- (A) Estrogen (B) Progesterone (C) LH (D) FSH

Q.152 Release of egg from ovary is called

- (A) Ovipary (B) Ovulation (C) Hatching (D) All of the above

Q.153 Pseudopregnancy is due to

- (A) Polyembryony (B) Absence of fertilization after ovulation
(C) Hormonal disturbance (D) All the above

Q.154 A polyestrous mammalian example is

- (A) Man (B) Cat (C) New age monkey (D) All the above

Q.155 In mammals except primates, heat condition develops in

- (A) Late stage of pre estrus phase (B) Estrus phase
(C) Early stage of meta estrus phase (D) Diestrus phase

Q.156 Polyspermy is common in

- (A) Frog (B) Man (C) Birds (D) Sea-urchin

Q.157 In which external fertilization is seen

- (A) Reptile (B) Birds (C) Chondrichthyes (D) None

Q.158 Type of fertilization (external or internal) depends on

- (A) Structure of egg (B) Site of embryo development
(C) Type of sperm (D) A and B both

Q.159 Adaptation for approach of sperm of egg in mammals

- (A) Sperm kept inactive till ejaculation (B) Very high number of sperm
(C) Peristalsis of oviduct (D) All the above

Q.160 Motion of sperm is

- (A) Chemotaxis (B) Rheotaxis (C) Hydrotropism (D) Random

Q.161 Internal fertilization in animals is mainly concerned

- (A) With presence of copulatory organ (B) To ensure fertilization
(C) With an adaption to the terrestrial life (D) With conservation of semen

Q.162 The chemical substance called fertilizing performs which of the following function

- (A) It activates the sperm (B) It attracts the sperm by positive chemotaxis
(C) It agglutinates sperm (D) None

Q.163 The process of fertilization in sea urchin was originally noticed by

- (A) O-Hertwing (B) Fleming (C) Waldyer (D) Wilson

Q.164 The most important significance of fertilizing & antifertilizin reaction is to

- (A) Preserve the sperm
(B) Ensure that at least few spermatozoa encounter the egg
(C) Mutually attract the gametes of opposite sexes
(D) Ensure fusion of gamete of same species

Q.165 In which of the following fertilization occurs externally in water?

- (A) Hydra (B) Frog (C) Both (D) None

Q.166 Antifertilizin is

- (A) Glycoprotein (B) Simple acidic protein
(C) Carbohydrate (D) None

Q.167 Fertilization can be correctly defined as fusion of

- (A) Male and female pronuclei
(B) Cytoplasm of male & female gametes
(C) Two gametes
(D) Male and female gametes of the same species

Q.168 Polyspermy is normally prevented by

- (A) The fertilizing and antifertilizin reaction (B) Repulsion of excess number of sperm by ova
(C) In ability of some sperms to penetrate ova (D) Formation of fertilization membrane

Q.169 External fertilization mostly occurs in those animal which

- (A) Lay eggs in soil (B) Lay egg in water (C) Are viviparous (D) Are oviparous

Q.170 The enzyme hyaluronidase helps in penetration of sperm in to egg. It is

- (A) Present in sperm (B) Present in ovum
(C) Present in sperm & ovum both (D) Derived from the external medium

Q.171 Natural parthenogenesis occurs in

- (A) Dog (B) Honey-bee (C) Frog (D) House – fly

Q.172 Process of formation of an individual without contribution of father is called as

- (A) Epigenesis (B) Pangenesis (C) Induction (D) Parthenogenesis

Q.173 Development of an unfertilized egg is called

- (A) Parthenogenesis (B) Metamorphosis (C) Gametogenesis (D) Paedogenesis

Q.174 Haploid parthenogenesis is called

- (A) Amphitoky (B) Deuterotoky (C) Thelytoky (D) Arrhenotoky

Q.175 Cleavage starts in zygote

- (A) In uterus (B) In Fallopian tube (C) In Vagina (D) In Cervix

Q.176 After which stage cleavage stopped

- (A) After Morula (B) After Blastula (C) After Gastrula (D) Any time it stops

Q.177 How many cleavages are required for formation of 16 Blastomeres

- (A) 2 (B) 4 (C) 6 (D) 8

Q.178 The Blastomeres in the blastocyst are arranged into an outer layer called _____A_____, and inner group of cells attached to trophoblast called the _____B_____.

- (A) A is trophoblast and B are inner cell mass (B) A are inner cell mass and B is trophoblast
(C) Both are trophoblast (D) Both are inner cells mass

Q.179 Cells formed as a result of cleavage are called

- (A) Megameres (B) Micromeres (C) Blastoderm (D) Blastomeres

Q.180 Cleavage in human is

- (A) Equal (B) Unequal (C) Superficial (D) Not possible

Q.181 Types of cleavage in centrolecithal eggs

- (A) Spiral (B) Superficial (C) Discoidal (D) Unequal holoblastic

Q.182 Cell-division in zygote is called

- (A) Cleavage (B) Segmentation (C) Cellulation (D) All the above

Q.183 What happens in cells of embryo during cleavage?

- (A) Decrease in cytoplasm (B) Increase in cytoplasm and decrease in nuclear material
(C) Decrease in both (D) Both remains constant

Q.184 Cleavage start in man in

- (A) Fallopian tube (B) Uterus (C) Vagina (D) None

Q.185 Which of the following characteristics does not belong to cleavage

- (A) Decrease in size of blastomeres (B) Rapid mitotic cell division
(C) Interphase of very short duration (D) Differentiation of blastomeres

Q.186 When a zygote divides completely into blastomeres, the type of cleavage is called

- (A) Holoblastic (B) Meroblastic (C) Fertilization (D) Metamorphosis

Q.187 Cleavage start in man in

- (A) Fallopian tube (B) Uterus (C) Vagina (D) None

Q.188 Three germ layers are formed during which stage of embryonic development

- (A) Morula (B) Blastula (C) Gastrula (D) In any two stages

Q.189 Movement of blastomeres usually seen in which embryonic stage

- (A) Morula (B) Blastula (C) Gastrula (D) In all embryonic stages

Q.190 The first movements of the foetus and appearance of hair on the head are usually observed during the

- (A) 3rd month (B) 4th month (C) 5th month (D) 8th month

Q.191 Late gastrula has

- (A) Ectoderm (B) Mesoderm (C) Endoderm (D) All

Q.192 In rabbit at the time of fertilization zygote is formed in

- (A) Coelom (B) Fallopian tube (C) Uterus (D) Vagina

Q.193 In which stage rate of cell-division decrease?

- (A) Morula (B) Gastrula (C) Blastula (D) Zygote

Q.194 Fate map of embryo is prepared in which stage?

- (A) Morula (B) Blastula (C) Gastrula (D) Nerula

Q.195 Solid ball of cell produced by repeated cleavage is called

- (A) Gastrula (B) Blastula (C) Morula (D) Nerula

Q.196 Archenteron is cavity in

- (A) Blastula (B) Gastrula (C) Nerula (D) Morula

Q.197 Which statement is not correct for gastrulation

- (A) Formation of archenteron (B) Cell division stops
(C) Oxidation reaction increase (D) Elongation of embryo starts

Q.198 Blastopore normally develops into frog

- (A) Anus (B) Mouth (C) Anus or mouth (D) None of these

Q.199 Cavity formed during gastrulation and found in mature gastrula is

- (A) Blastocoels (B) Archenteron (C) Neurocoel (D) Pseudocoel

Q.200 Gastrulation is a process

- (A) Which begins the segregation of germ layers (B) That occurs just after morulation
(C) That occur just after cleavage (D) Of rapid growth in blastomeres

Q.209 In parturition process, which of the following does not happen

- (A) Oxytocin hormone is secreted by posterior pituitary
- (B) Relaxin hormone responsible for narrowing of pelvic cavity
- (C) Progesterone hormone secretion is stopped
- (D) General position of foetus is occipito-anterior

Q.210 Foetal ejection reflex in human female is induced by

- (A) Differentiation of mammary glands
- (B) Pressure exerted by amniotic fluid
- (C) Release of oxytocin from pituitary
- (D) Fully developed foetus and placenta

Q.211 Oxytocin is mainly help in

- (A) Milk production
- (B) Child birth
- (C) Urine formation
- (D) gametogenesis

Q.212 External/accessory sexual characters first appear in

- (A) Childhood
- (B) Puberty
- (C) Foetus
- (D) Adulthood

Q.213 Voice is high pitched in

- (A) Aged persons
- (B) Adult males
- (C) Boys
- (D) Females

Q.214 Abnormal conditioning when the mammary glands of man become female like is called

- (A) Feminization
- (B) Gonochorism
- (C) Gynacomastism
- (D) Gynoecism

Q.215 In prototherians mammary glands are

- (A) Absent
- (B) Present in male only
- (C) Present in female only
- (D) Present in male and female both

Q.216 Which following homologous structures are mismatched

- (A) Clitoris and penis (B) Vagina and prostatic utricle
(C) Uterus and seminal vesicle (D) Fallopian tube and prostate

Q.217 Which is not correct about secondary sexual characters of female

- (A) Development of mammary gland (B) Presence of pubic hair
(C) Low pitched voice (D) Menarche

Q.218 Frog is

- (A) Reflex ovulator (B) Spontaneous ovulator
(C) Non ovulator (D) None of these

Q.219 Testicular degeneration and other disorders of reproductive system in mammals are due to the deficiency of

- (A) Vitamin D (B) Vitamin B (C) Vitamin K (D) Vitamin E

Q.220 Father of modern embryology

- (A) Von Baer (B) Haeckel (C) Aristotle (D) Robert Hook

Q.221 "Father of embryology" is

- (A) Spemann (B) Von Baer (C) Aristotle (D) Bonnet

Q.222 Development of animal by asexual reproduction is called

- (A) Ontogenesis (B) Embryogenesis
(C) Blastogenesis (D) Morphalloaxis

Q.223 In the following which vitamin essential for gametogenesis?

- (A) Vit A and E (B) Vit C and D
(C) Vit E and K (D) Vit E and B complex

Q.224 What will happen to spermatozoa at 0°C temperature

- (A) All sperm will die
- (B) There will be no change
- (C) They will become inactive temporarily
- (D) Tails will be lost

Q.225 Which of the following embryonic layer formed gametes

- (A) Ectoderm
- (B) Endoderm
- (C) Mesoderm
- (D) Mesoderm and Endoderm

Q.226 Each testis has how many testicular tubules

- (A) About 100
- (B) About 50
- (C) About 250
- (D) Infinite

Q.227 The male accessory glands include

- (A) Prostate gland
- (B) Bulbourethral gland
- (C) Seminal vesicles
- (D) All of the above

Q.228 In male penis is covered by a loose fold of skin is called

- (A) Foreskin
- (B) Urethral meatus
- (C) External genitalia
- (D) Fimbriae

Q.229 The function of fimbriae

- (A) Collection of the ovum after ovulation
- (B) Maintain the shape of ovary
- (C) Provide the path to sperm during fertilization
- (D) None of these

Q.230 Which statement is wrong

- (A) Mammary lobes containing clusters of cells called alveoli
- (B) Uterus is also called womb
- (C) The last part of the oviduct is called Ampulla
- (D) Stroma of ovary divided into two zone

Q.231 Spermatogenesis started then increase the secretion of

- (A) GnRH (B) LTH (C) Oxytocin (D) Relaxin

Q.232 Antrum is

- (A) Fluid filled follicle cavity (B) An Inner theca interna
(C) The mature follicle (D) Fluids less follicle cavity

Q.233 Ovulation is

- (A) Releasing of secondary oocyte from ovary
(B) Releasing of primary oocyte from ovary
(C) Releasing of polar body
(D) Releasing of Graafian follicle

Q.234 For normal fertility, how many percentage of sperm must have normal shape and size

- (A) 50% (B) 25% (C) 40% (D) 60%

Q.235 In which duration menstrual cycle both LH & FSH attain a peak level

- (A) In last week (B) Middle of cycle
(C) Initial days of cycle (D) 4th day of cycle

Q.236 Which statement is not correct

- (A) In the absence of fertilization , the corpus luteum degenerates
(B) During pregnancy all events of menstrual cycle stop
(C) The secretion of LH & FSH decreases gradually during the follicular phase
(D) The menstrual flow results due to breakdown of endometrial lining

Q.237 In which phase of menstrual cycle Graafian follicle transform as the corpus luteum

- (A) Luteal (B) Proliferation (C) Follicular (D) Growth

Q.238 Which hormones is essential for maintenance of the endometrium

- (A) FSH (B) LH (C) Progesterone (D) Testosterone

Q.239 Which of the following is an indicator of normal reproductive phase and extends between menarche and menopause

- (A) Menstruation cycle (B) Estrous cycle
(C) Ovulation (D) Implantation

Q.240 Fertilization takes place at

- (A) Cervix (B) Ampullary – isthmic junction
(C) Isthmus (D) Vagina

Q.241 The embryo with 8 to 16 blastomeres is called

- (A) Morula (B) Blastula (C) Gastrula (D) Foetus

Q.242 During implantation, the blastocyst becomes embedded in the which layer of uterus

- (A) Trophoblast (B) Endometrium (C) Myometrium (D) Perimetrium

Q.243 The mitotic division starts as the zygote moves through the _____ of the oviduct called cleavage

- (A) Ampulla (B) Isthmus (C) Fimbria (D) Infundibulum

Q.244 During fertilization, a sperm comes in contact with the which layer of the ovum

- (A) Jelly coat (B) Zona pellucid
(C) Vitelline membrane (D) Perivitelline space

Q.245 Function of placenta is

- (A) Supply of O_2 to embryo
(B) Removal of CO_2 produced by the embryo
(C) Produces several hormones
(D) All of the above

Q.246 Stem cells are found in

- (A) Inner cell mass (B) Ectoderm
(C) Endoderm (D) Mesoderm

Q.247 The first sign of growing foetus may be noticed by

- (A) Listening to the heart sound carefully through the stethoscope
- (B) Appearance of hair
- (C) Appearance of head
- (D) Appearance of eye lids

Q.248 During pregnancy only which hormones are secreted in women

- (A) Progesterone
- (B) hPL
- (C) Estrogen
- (D) Thyroxin

Q.249 Placenta contains

- (A) Only chorionic villi
- (B) Only uterine tissue
- (C) Chorionic villi + uterine tissue
- (D) Trophoblast + chorionic villi

Q.250 The average duration of human pregnancy is about nine months which is called

- (A) Gestation period
- (B) Parturition
- (C) Lactation
- (D) Implantation

Q.251 Parturition is induced by

- (A) A complex neuroendocrine mechanism
- (B) A simple neuroendocrine mechanism
- (C) A neuro exocrine mechanism
- (D) A physio- chemical mechanism

Q.252 The signals for parturition originate from

- (A) Fully developed foetus
- (B) Placenta
- (C) Both (A) and (B)
- (D) Uterus

Q.253 Which hormone acts on the uterine during parturition

- (A) Oxytocin (B) LH (C) Estrogen (D) Relaxin

Q.254 Which gland of female undergo differentiation during pregnancy

- (A) Thyroid (B) Mammary (C) Pituitary (D) Thymus

Q.255 Which is correct for colostrum

- (A) It contains several antibodies
(B) It produced during the last days of lactation
(C) It is a pheromone
(D) It is white in colour

Previous Years' Questions

Q.1 Cryptorchidism is a condition of testes

[AIIMS 83, WARDHA 2000, 02]

- (A) Unable to descend in scrotal sacs
(B) Unable to produce sperms
(C) Having been surgically removed
(D) Having remained undeveloped

Q.2 In between spermatogonia are found

[CPMT 87]

- (A) Germinal cells (B) Sertoli cells
(C) Epithelial cells (D) Lymph space

Q.3 Cells of Leydig occur in

[MANIPAL 95]

- (A) Liver (B) Ovary (C) Testis (D) Spleen

Q.4 Location and secretion of Leydig cells are

[CBSE 91]

- (A) Liver- cholesterol (B) Ovary-oestrogen
(C) Testis- Testosterone (D) Pancreas- Glucagon

Q.5 Which accessory genital gland occurs only in male mammal **[CPMT 91]**

- (A) Bartholin's gland (B) Perineal gland
(C) Prostate gland (D) All of the above

Q.6 Seminiferous tubules occur in **[MP PMT 87]**

- (A) Liver (B) Kidney (C) Ovary (D) Testis

Q.7 Sugar fructose is present in the secretion of **[ORRISA JEE 95]**

- (A) Seminal vesicle (B) Perineal gland
(C) Cowper's gland (D) Bartholin's gland

Q.8 What would happen if vasa deferentia of man are cut **[MP PMT 93]**

- (A) Sperms are non-nucleate (B) Spermatogenesis does not occur
(C) Semen is without sperms (D) Sperm are non-motile

Q.9 Which one is primary sex organ **[ROHTAK PMT 93]**

- (A) Scrotum (B) Penis (C) Testis (D) Prostrate

Q.10 Cowper's gland are found in **[MP 94, 95]**

- (A) Male mammals (B) Female birds
(C) Male amphibians (D) Female amphibians

Q.11 A female gland corresponding to prostate of males is **[MP PMT 93]**

- (A) Bartholin's' gland (B) Bulbourethral gland
(C) Clitoris (D) None of these

Q.12 Secondary sex organ is **[MP 93]**

- (A) Testis (B) Ovary (C) Beard (D) Vasa deferens

Q.13 Which gland secretes odorous secretion in mammals **[CBSE 2000]**

- (A) Bartholin's (B) Prostate (C) Anal gland (D) Liver-bile

Q.14 In mammals, maturation of sperms take place at a temperature **[MP PMT 1991]**

- (A) Equal to that of body (B) Higher than that of body
(C) Lower than that of body (D) At any piece of mammalian sperm

Q.15 What would happen if vasa deferentia of man are cut? **[MP PMT 1993]**

- (A) Sperms are non-nucleate (B) Spermatogenesis does not occur
(C) Semen is without sperms (D) Sperms are non-motile

Q.16 Prostate gland produces a secretion for **[BHU 1996]**

- (A) Stimulating Attract (B) Stimulating sperm activity
(C) Attractive egg (D) None of the above

Q.17 Seminal vesicles are located in **[MANIPAL 1999]**

- (A) Caput epididymis (B) Uterus
(C) Above Cowper's glands (D) Glans penis

Q.18 Head of epididymis present at head of testis is **[CPMT 2000]**

- (A) Caput epididymis (B) Cauda epididymis
(C) Vas deferens (D) Gubernaculum

Q.19 Glands secreting male sex hormone are **[PB PMT 2000]**

- (A) Leydig cells (B) Seminiferous tubules
(C) Vasa deferentia (D) Testes

Q.20 Testes descent into scrotum in mammals for **[AFMC 2001]**

- (A) Spermatogenesis (B) Fertilization
(C) Development of sex organs (D) Development of visceral organs

Q.21 Nutritive cells of seminiferous tubules are **[KERAL 2003]**

- (A) Leydig cells (B) Sertoli cells
(C) Atretic follicular cells (D) Spermatogonial cells

Q.22 The animal in which testes descent into scrotum only during breeding season **[AFMC 2004]**

- (A) Frog (B) Kangaroo (C) Shrew (D) Bat

Q.23 Sertoli cells are regulated by the pituitary hormone known as **[CBSE 2006]**

- (A) FSH (B) GH (C) Prolactin (D) LH

Q.24 Seminal plasma in humans is rich in **[CBSE 2009]**

- (A) Fructose and certain enzymes but poor in calcium
(B) Fructose, calcium and certain enzymes
(C) Fructose and calcium but has no enzymes
(D) Glucose and certain enzymes but has no calcium

Q.25 Which of the following is not a long term contraception method? **[CBSE 2009]**

- (A) Sub cutaneous implants (B) Vasectomy
(C) Use of a condom (D) Tubectomy

Q.26 Spermatozoa are nourished during their development by **[ORRISA JEE 95]**

- (A) Sertoli cells (B) Interstitial cells
(C) Connective tissue cells (D) None of these

Q.27 If somatic chromosomes number is 40. What shall be chromosomal number in the cell of seminiferous tubules **[AFMC 94]**

- (A) 40 (B) 20 (C) 10 (D) 40 and 20

Q.28 In the female Rabbit which structure is homologous to penis of male **[RPMT 2001]**

- (A) Cervix (B) Vagina (C) Uterus (D) Clitoris

Q.29 Endometrium is lining of **[CPMT 88]**

- (A) Testis (B) Urinary bladder (C) Uterus (D) Ureter

Q.30 A secondary sexual character is **[DPMT 82]**

- (A) Breast (B) Ovary (C) Thyroid (D) Thyroid

Q.31 Expanded proximal part of oviduct in female is **[DPMT 85]**

- (A) Uterus (B) Fallopian tube
(C) Fimbriated funnel (D) Vestibule

Q.33 Bartholin's glands are situated **[CBSE 2003]**

- (A) On the sides of the head of some amphibians (B) At the reduced tail end of birds
(C) On either side of vagina in humans (D) On either side of vas deferens in humans

Q.34 Bartholin's glands occurs in **[MP PMT 1992]**

- (A) Females and help in vestibular lubrication
(B) Females and produce oestrogen for regulating secondary sexual characters
(C) Males and form liquid part of spermatic fluid
(D) Males and produce alkaline fluid for neutralizing urethral acidity

Q.35 A female gland corresponding to prostate of males is? **[MP PMT 1993]**

- (A) Bartholin's gland (B) Bulbourethral gland
(C) Clitoris (D) None of the above

Q.36 Mullerian duct is **[MP PMT 2000]**

- (A) Ureter (B) Urethra (C) Sperm duct (D) Oviduct

Q.37 Spermatogenesis and sperm differentiation are under the control of **[CPMT 87]**

- (A) FSH (B) LH (C) Progesterone (D) Parathyroid Hormone

Q.38 Human sperm was discovered by **[DPMT 1996]**

- (A) Leeuwenhoek (B) Aristotle (C) Graaf (D) Pander

Q.39 At the end of first meiotic division, male germ cell differentiates into **[C.B.S.E.1994; M.P.P.M.T.96]**

- (A) Secondary spermatocyte (B) Primary spermatocyte
(C) Spermatogonium (D) Spermatid

Q.40 A mature sperm has **[AFMC 1994]**

- (A) A pair of flagella
(B) A nucleus, an acrosome and a centriole
(C) A nucleus, an acrosome, a pair of centrioles
(D) A nucleus, an acrosome, a pair of centrioles and a tail

Q.41 Middle piece of mammalian sperm contains **[AIIMS 1998, CBSE 99]**

- (A) Nucleus (B) Vacuoles (C) Mitochondria (D) Centriole

Q.42 The head of mature mammalian sperm is made of **[AIIMS 1999]**

- (A) An acrosome
(B) Elongated nucleus covered by acrosome
(C) Two centrioles and an axial filament
(D) Nucleus, acrosome, cytoplasm and mitochondrial sheath

Q.43 Which part of sperm provides energy it to fertilize, the egg **[RPMT 2001]**

- (A) Sperm head (B) Acrosome (C) Sperm tail (D) Middle piece

Q.44 At which stage of spermatogenesis sperm acquire their whole structural maturity and they contain a haploid nucleus and other organs **[RPMT 2002]**

- (A) Spermiogenesis (B) Growth phase
(C) Multiplication phase (D) Maturation phase

Q.45 Which part of the spermatid forms acrosome of sperm? **[RPMT 2004]**

- (A) Mitochondria (B) Golgi body (C) Nucleus (D) Lysosome

Q.46 How many sperms are formed by one primary spermatocyte? **[RPMT 2005]**

- (A) 4 (B) 2 (C) 3 (D) 1

Q.47 In humans, at the end of the first meiotic division, the male germ cells differentiate into the **[CBSE 2008]**

- (A) Spermatids (B) Spermatogonia
(C) Primary spermatocytes (D) Secondary spermatocytes

Q.48 The correct sequence of spermatogenetic stages leading to the formation of sperms in a mature human testis is **[CBSE 20089]**

- (A) Spermatogonia – Spermatid – Spermatocyte – Sperms
(B) Spermatocyte – Spermatogonia – Spermatid – Sperms
(C) Spermatogonia – Spermatocyte – Spermatid – Sperms
(D) Spermatid – Spermatocyte – Spermatogonia – Sperms

Q.49 10 oogonia yield 10 primary oocytes, then how many ova are produced on completion of oogenesis
[RPMT 2001]

- (A) 5 (B) 10 (C) 20 (D) 40

Q.50 Human eggs are **[C.B.S.E.1991, 97; M.P.P.M.T. 2000]**

- (A) Alecithal (B) Microlecithal
(C) Mesolecithal (D) Macrolecithal

Q.51 Human egg has **[C.B.S.E. 1991; MANIPAL 95; M.P.P.M.T.2000]**

- (A) One Y –chromosome (B) One X-chromosome
(C) Two Y-chromosome (D) One X-chromosome and one Y –chromosome

Q.52 In telolecithal egg the yolk is found **[C.B.S.E.1993]**

- (A) All over the egg (B) On one side
(C) Both the sides (D) Centre

Q.53 Reptile and birds eggs are **[AIIMS 1996]**

- (A) Macrolecithal (B) Oligoleithal
(C) Mesolecithal (D) Alecithal

Q.54 Egg with peripheral cytoplasm around the yolk is **[AIIMS 1998]**

- (A) Isolecithal (B) Microlecithal
(C) Telolecithal (D) Centrolecithal

Q.55 Polar body is produced during the formation of **[PB PMT 1999]**

- (A) Sperm (B) Secondary oocyte
(C) Oogonium (D) Spermatocytes

Q.56 Oocyte is liberated from ovary under the influence of LH, after completing **[AIIMS 2001]**

- (A) Mitosis and before liberating polar bodies
(B) Meiosis I and before liberating second polar bodies
(C) Meiosis
(D) Meiosis II after release of first polar body

- Q.57** Noncleidic eggs occur in **[BHU 2001]**
(A) Birds (B) Fish (C) Reptiles (D) Platypus
- Q.58** Microlecithal eggs are found in **[RPMT 2001]**
(A) Reptilia + Aves (B) Amphibia + Aves + Reptilia
(C) Reptilia + Aves + Chiroptera (D) Eutheria
- Q.59** Which have macrolecithal eggs? **[RPMT 2001]**
(A) Aves , Reptilia (B) Aves, Reptilia, Amphibia
(C) Aves, Reptilia, Chiroptera (D) Aves, Eutheria
- Q.60** Cleidoic egg is an adaptation for **[RPMT 2001]**
(A) Aquatic life (B) Marine life
(C) Terrestrial life (D) Aerial life
- Q.61** In mammals egg are microlecithal and isolecithal because these are **[RPMT 2001]**
(A) Oviparous (B) Viviparous
(C) Ovoviviparous (D) None of them
- Q.62** Eggs of birds are **[RPMT 2001]**
(A) Microlecithal (B) Centrolecithal
(C) Megalecithal (D) Alecithal
- Q.63** Insects's eggs are **[RPMT 2002]**
(A) Microlecithal and centrolecithal (B) Megalecithal and isolecithal
(C) Megalecithal and centrolecithal (D) Megalecithal and telocithal
- Q.64** Extrusion of second polar body from egg nucleus occurs **[C.B.S.E. 1993]**
(A) After entry of sperm before completion of fertilization
(B) After completion of fertilization
(C) Before entry of sperm
(D) Without any relation of sperm entry.

Q.65 Estrogen is secreted by **[HR. PMT 2000]**

- (A) Corpus luteum (B) Membranous granulosa of Graafian follicle
(C) Germinal epithelium of ovary (D) Pituitary

Q.66 Mammalian placenta originates from **[MP PMT 2002]**

- (A) Allantois and chorion (B) Yolk sack
(C) Allantois (D) Amnion

Q.67 Number of eggs released in the life time of a woman is approximately **[KARNATAKA 1999]**

- (A) 40 (B) 400 (C) 4000 (D) 20000

Q.68 Graffian follicle are found in **[DPMT 82, BHU 85]**

- (A) Testis of mammal (B) Ovary of frog
(C) Ovary of cockroach (D) Ovary of mammals

Q.69 In mammals, corpus luteum is found in which organ **[RPMT 2002]**

- (A) Brain (B) Ovary (C) Liver (D) Eyes

Q.70 Which temporary endocrine gland forms in ovary after ovulation **[RPMT 2003]**

- (A) Corpus collosum (B) Corpus albicans
(C) Corpus luteum (D) Corpus striata

Q.71 Which set is similar **[CBSE 2001]**

- (A) Corpus luteum – Graafian follicles (B) Sebum –sweat
(C) Bundle of his –Pacemaker (D) Vita B7- Niacin

Q.72 When both ovary are removed from rat then which hormone is decreased in blood **[CBSE 2002]**

- (A) Oxytocin (B) Prolactin
(C) Estrogen (D) Gonadotrophic releasing factor

Q.73 Corpus luteum develops from **[BHU 1993, KERALA 2001]**

- (A) Oocyte (B) Nephrostome
(C) Graafian follicle (D) None of the above

Q.74 Corpus luteum secretes **[PB. PMT 1997, AMU 2001]**

- (A) LH (B) Estrogen (C) Progesterone (D) FSH

Q.75 In case of nonfertilization, corpus luteum **[CPMT 1997]**

- (A) Stops secreting progesterone (B) Changes to corpus albicans
(C) Starts producing progesterone (D) None of the above

Q.76 Antrum is cavity for **[KARNATAKA 2001]**

- (A) Ovary (B) Graafian follicle (C) Blastula (D) Gastrula

Q.77 Which part of ovary in mammals acts as in endocrine gland after ovulation? **[CBSE 2007]**

- (A) Vitelline membrane (B) Graafian follicle
(C) Stroma (D) Germinal epithelium

Q.78 Which one of the following is the correct matching of the events occurring during menstrual cycle? **[CBSE 2009]**

- (A) Menstruation : Breakdown of myometrium and ovum not fertilized
(B) Ovulation: LH and FSH attain peak level and sharp fall in the secretion of progesterone.
(C) Proliferative phase : Rapid regeneration of myometrium and maturation of Graafian follicle
(D) Development of corpus luteum : Secretory phase and increased secretion of progesterone

Q.79 Graafian follicles contain **[MP PMT 1992]**

- (A) Corpus luteum (B) Corpus albicans
(C) Theca externa and theca interna (D) Oogonial cells

Q.80 After ovulation, Graafian follicle forms **[CBSE 1999]**

- (A) Corpus luteum (B) Corpus albicans
(C) Corpus artesia (D) Corpus callosum

Q.81 Graafian follicle contains **[MP PMT 2000]**

- (A) Many oocytes (B) Many sperms
(C) A single oocyte (D) Site for egg fertilization

Q.97 Yellow corpus luteum occurs in a mammals in

[MP PMT 1993, 98 CBSE 95]

- (A) Heart to initiate heart beat
- (B) Skin to function as pain receptor
- (C) Brain and connects cerebral hemispheres
- (D) Ovary for secretion of progesterone

Q.98 Correct sequence of hormone secretion from beginning of menstruation is **[AIIMS 1999, ORISSA 04]**

- (A) FSH, progesterone, estrogen
- (B) Estrogen, FSH, progesterone
- (C) FSH, estrogen, progesterone
- (D) Estrogen, progesterone, FSH

Q.99 Progesterone level falls leading to

[MP PMT 2000]

- (A) Gestation
- (B) Menopause
- (C) Lactation
- (D) Menstruation

Q.100 Human female reaches menopause at the age of about

[AFMC 2000]

- (A) 25 years
- (B) 35 years
- (C) 50 years
- (D) 70years

Q.101 Phase of menstrual cycle when ovulation occurs in

[WARDHA 2001]

- (A) Luteal
- (B) Menstrual
- (C) Proliferative
- (D) Secretary

Q.102 Hormone responsible for ovulation and development of corpus luteum is

[JIMPER 2002]

- (A) FSH
- (B) LH
- (C) LTH
- (D) ICSH

Q.103 Hormone controlling human menstrual cycle

[CBSE 2002]

- (A) Estrogen
- (B) FSH
- (C) LH
- (D) All of the above

Q.104 Phase of menstrual cycle in human that lasts for 7-8days is

[AIIMS 2003]

- (A) Follicular phase
- (B) Ovulatory phase
- (C) Luteal phase
- (D) Menstruation

Q.105 Menstruation is caused by

[D. PMT 2003]

- (A) Increase in FSH level (B) Fall in oxytocin level
(C) Fall in progesterone level (D) Increase in oestrogen level

Q.106 In the human female, menstruation can be deferred by the administration of

[CBSE 2007]

- (A) FSH only
(B) LH only
(C) Combination of FSH and LH
(D) Combination of estrogen and progesterone

Q.107 Which one of the following statements is incorrect about menstruation?

[CBSE 2008]

- (A) At menopause in the female, there is especially abrupt increase in gonadotropic hormones
(B) The beginning of the cycle of menstruation is called menarche
(C) During normal menstruation about 40 ml blood is lost
(D) The menstrual fluid can easily clot

Q.108 In uterus, endometrium proliferates in response to

[KERALA 2004]

- (A) Relaxin (B) Oxytocin (C) Progesterone
(D) Oestrogen (E) LH

Q.109 Immediately after ovulation, the mammalian egg is covered by a membrane called

[AIIMS 1998]

- (A) Chorion (B) Zona pellucid
(C) Corona radiata (D) 2 and 3

Q.110 Ovulation occurs under the influence of

[KARNATAKA 1994, CBSE 94, and AIIMS 96]

- (A) LH (B) FSH (C) Estrogen (D) Progesterone

Q.111 Ovulation or release of ovum occurs on the day of menstrual cycle

[MANIPAL2000]

- (A) 8-10 (B) 12-14
(C) 4-14 (D) Last two day of menstrual cycle

Q.112 Monoestrous cycle animals may have **[MP 95]**

- (A) One ovulation each month (B) One egg
(C) One breeding season in a year (D) One menses each month

Q.113 Estrous cycle is characteristic of **[CBSE 95]**

- (A) Human females (B) Mammalian females
(C) Mammalian females other than primates (D) Mammals

Q.114 Estrous cycle is indication of? **[MP PMT 1993]**

- (A) Breeding period (B) Estrogen secretion
(C) Pregnancy (D) Menopause

Q.115 Site of fertilization in mammal is **[MP PMT 88, 95, BHU 89]**

- (A) Ovary (B) Uterus (C) Vagina (D) Fallopian tube

Q.116 In mammals, egg is fertilized in **[RPMT 2003]**

- (A) Ovary (B) Fallopian tube (C) Uterus (D) Vagina

Q.117 Fertilizinis are emitted by **[CBSE 1991, 91; BHU 85; CPMT 97, JLPMER 2000]**

- (A) Immature eggs (B) Mature eggs
(C) Sperms (D) Polar bodies

Q.118 Acrosome reaction in sperm is triggered by **[C.B.S.E.1993]**

- (A) Capacitation (B) Release of lysine
(C) Influx of Na⁺ (D) Release of fertilizin

Q.119 Fertilization is **[KARNATAKA 1994]**

- (A) Union of diploid spermatozoon with diploid ovum to form diploid zygote
(B) Union haploid sperm with haploid ovum to form haploid zygote
(C) Union of haploid sperm with haploid ovum to form diploid zygote
(D) Union of diploid sperm with haploid ovum to from triploid zygote

Q.127 During cleavage, what is true about embryo?

[C.B.S.E. 1991. C.P.M.T.99]

- (A) Nucleocytoplasmic ratio remains unchanged
- (B) Size does not increase
- (C) There is less consumption of oxygen
- (D) The division is like meiosis

Q.128 Meroblastic cleavage is division

[C.B.S.E. 1992; M.P.P.M.T. 97; KARN. 98]

- (A) Horizontal
- (B) Partial / parietal
- (C) Total
- (D) Spiral

Q.129 Amount of yolk and its distribution are changed in the egg. Which one is affected? **[C.B.S.E 1993]**

- (A) Pattern of cleavage
- (B) Formation of zygote
- (C) Number of blastomeres
- (D) Fertilization

Q.130 What is true about cleavage in fertilized egg of humans?

[C.B.S.E. 1994]

- (A) Meroblastic
- (B) Starts when egg reaches uterus
- (C) Starts in fallopian tubes
- (D) It is identical to normal mitosis

Q.131 Type of cleavage in an egg is determined by

[CBSE 1995, RPMT 99]

- (A) Amount and distribution of yolk
- (B) Number of egg membranes
- (C) Size and location of nucleus
- (D) Shape and size of sperm

Q.132 Cleavage in the fertilized egg of humans

[AFMC 1999]

- (A) Starts in uterus
- (B) Is meroblastic
- (C) Starts when egg is in fallopian tube
- (D) Is discoidal

Q.133 Division of human egg is

[CBSE 2000]

- (A) Equal holoblastic
- (B) Unequal holoblastic
- (C) Superficial meroblastic
- (D) Discoidal meroblastic

Q.134 In which one meroblastic cleavage is found **[RPMT 2000]**

- (A) Dog (B) Owl (C) Monkey (D) Rhinoceros

Q.135 Which cell div. is found during cleavage? **[RPMT 2001]**

- (A) Amitosis (B) Mitosis (C) Closed mitosis (D) Meiosis

Q.136 In which of the following animal cleavage divisions are restricted to a small part of cytoplasm and nucleus in animal pole of egg? **[RPMT 2002]**

- (A) Cockroach (B) Frog (C) Chick (D) Rabbit

Q.137 In mesolecithal eggs, the cleavage is **[RPMT 2004]**

- (A) Equal , holoblastic (B) Unequal holoblastic
(C) Meroblastic (D) Discoidal

Q.138 What is true for cleavage **[CBSE 2002]**

- (A) Size of embryo increases (B) Size of cells decrease
(C) Size of cells increase (D) Size of embryo decreases

Q.139 Termination of gastrulation is indicated by **[C.B.S.E 1993]**

- (A) Obliteration of blastocoels (B) Obliteration of archenteron
(C) Closure of blastopore (D) Closure of neural tube

Q.140 Which of the following is not the correct for gastrulation? **[RPMT 2002]**

- (A) Archenteron is formed
(B) All germinal layers are formed
(C) Morphogenetic movements
(D) Some blastomeres & blastocoels degenerate

Q.141 Completion of gastrulation is indicated by **[RPMT 2003]**

- (A) Obliteration of archenteron (B) Obliteration of blastocoels
(C) Closing of blastopore (D) Closing of neural tube

Q.142 What is formed at the time of gastrulation?

[RPMT 2004]

- (A) Gills (B) Heart (C) Myotome (D) Archenteron

Q.143 Blastopore is the pore of

[CBSE 2000]

- (A) Archenteron (B) Blastocoels (C) Coelom (D) A.C.

Q.144 Correct sequence in development is

[CPMT 1998]

- (A) Fertilization → Zygote → Cleavage → Morula → Blastula → Gastrula
(B) Fertilization → Zygote → Blastula → Morula → Cleavage → Gastrula
(C) Fertilization → Cleavage → Morula → Zygote → Blastula → Gastrula
(D) Cleavage → Zygote → Fertilization → Morula → Blastula → Gastrula

Q.145 Placenta is the region where

[AFMC 1983]

- (A) Foetus is attached to mother by spermatic cord
(B) Foetus is provided with mother's blood
(C) Foetus receives nourishment from mother's blood
(D) Foetus is covered by membranes

Q.146 Parturition duct in female is called

[RPMT 2001]

- (A) Uterus (B) Oviduct (C) Vagina (D) Cervix

Q.147 Human beings are

[MP PMT 1993, 96]

- (A) Ovoviviparous (B) Oviparous
(C) Parthenogenetic (D) Viviparous

Q.148 During pregnancy, the urine of female would contain

[CPMT 93]

- (A) LH (B) Progesterone (C) FSH (D) HCG

Q.149 The lytic enzyme present in semen is

[UTTARANCHAL PMT 2004]

- (A) Ligase (B) Estrogenase (C) Androgenase (D) Hyaluronidase

Q.150 Progesterone hormone is secreted by

[JHARKHAND 2004]

- (A) Corpus albicans (B) Corpus collosum
(C) Corpus luteum in ovaries (D) Corpus uteri

Q.151 Sertoli cell are involved in

[JHARKHAND 2004]

- (A) Respiration (B) Nutrition of sperms
(C) Excretion (D) Development of sex organs

Q.152 In mammals corpus luteum is found in which organ

[JHARKHAND 2004]

- (A) Brain (B) Ovary (C) Liver (D) Eyes

Q.153 Testosterone is secreted by

[BIHAR 2004]

- (A) Leydig cells (B) Sertoli cells
(C) Seminiferous tubule (D) None of these

Q.154 Purpose of tubectomy is to prevent

[BIHAR 2004]

- (A) Fertilization (B) Coitus
(C) Egg formation (D) Embryonic development

Q.155 Progesterone is secreted by

[UP CPMT 2001]

- (A) Corpus aorta (B) Corpus albicans
(C) Corpus luteum (D) Corpus callosum

Q.156 In the urinogenital organs of rabbit which one of following part is present in male but not in female

[UP CPMT 2005]

- (A) Urethra (B) Fallopian tube
(C) Vagina (D) Vasa deferens

Q.157 Bidder's canal is present in

[UP CPMT 2006]

- (A) Female frog (B) Male frog
(C) Female rabbit (D) Male rabbit

Q.158 Which of the following causes abortion in ladies **[MP PMT 2007]**

- (A) Viruses (B) Bacteria
(C) Mycoplasma (D) None of these

Q.159 Accessory sexual character in female is promoted by **[MP PMT 2007]**

- (A) Androgen (B) Progesterone
(C) Estrogen (D) Testosterone

Q.160 Sertoli cells are found in testis. These cells are **[MP PMT 2007]**

- (A) Nurse cell (B) Reproductive cell
(C) Receptor cell (D) None of these

Q.161 Cryptorchidism is a condition in which **[MP PMT 2007]**

- (A) Testis does not descend into scrotal sac
(B) Sperm is not found
(C) Male hormones are not reactive
(D) Ovaries are removed

Q.162 The cellular layer that disintegrates and regenerates again and again in human is **[MP PMT 2004]**

- (A) Endometrium of uterus (B) Cornea of eye
(C) Dermis of skin (D) Endothelium of blood vessels

Q.163 The functional maturation of sperms takes place in **[MP PMT 2005]**

- (A) Oviduct (B) Epididymis (C) Vagina (D) All of these

Q.164 Surgical removal or cutting and ligation of the ends of oviduct is known as **[MP PMT 2006]**

- (A) Tubectomy (B) Oviductomy (C) Castration (D) Vasectomy

Q.165 The follicle that ruptures at the time of ovulation promptly fills with blood, forming **[MP PMT 2001]**

- (A) Corpus haemorrhagicum (B) Corpus luteum
(C) Corpus albicans (D) Corpus callosum

Q.174 Various changes in mammalian sperm which prepare it to fertilize the ovum are called **[UTTARANCHAL 2004]**

- (A) Capacitation (B) Regeneration
(C) Growth (D) None of these

Q.175 In gastrulation, which is (are) formed **[JHARKHAND 2005]**

- (A) Endoderm (B) Mesoderm
(C) Ectoderm, endoderm (D) Ectoderm, mesoderm, endoderm

Q.176 During oogenesis, the small structure separated from egg is **[JHARKHAND 2006]**

- (A) Polar bodies (B) Secondary endosperm
(C) Herring bodies (D) Hela cells

Q.177 Foetal sex is determined by examining cells from amniotic fluid looking for **[JHARKHAND 2004]**

- (A) Chiasmata (B) Autosomes
(C) Sex-chromosomes (D) Nucleus

Q.178 Which of the following is not correct for gastrulation **[JHARKHAND 2003]**

- (A) Archenteron is formed
(B) All germinal layers are formed
(C) Morphogenetic movements
(D) Blastomeres and Gastrocoel degenerate

Q.179 In human foetus, the heart begins to beat at developmental age of **[JHARKHAND 2002]**

- (A) 4th week (B) 3rd week (C) 6th week (D) 8th week

Q.180 Development of animal embryo from egg without fertilization is called **[BIHAR 2004]**

- (A) Parthenogenesis (B) Parthenocarp
(C) Apospory (D) Apomixes

Q.181 During embryonic development, endoskeleton and muscle develop from which germinal layer **[BIHAR 2006]**

- (A) Ectoderm (B) Endoderm (C) Mesoderm (D) Blastopore

Q.182 Polar bodies are produced during the formation of **[UP CPMT 2001]**

- (A) Sperm (B) Oogonium
(C) Spermatocytes (D) Secondary oocyte

Q.183 The part where fertilization of ovum occurs in placental mammals is **[UP CPMT 2001]**

- (A) Ovary (B) Uterus (C) Vagina (D) Fallopian tube

Q.184 In a vertebrate which germ layer forms the skeletal muscles **[UP CPMT 2004]**

- (A) Ectoderm (B) Endoderm
(C) Mesoderm (D) Both (A) and (B)

Q.185 Liver and pancreas of frog and rabbit are derived from **[UP CPMT 2006]**

- (A) Ectoderm (B) Mesentery (C) Endoderm (D) Both (A) and (C)

Q.186 Which layer develops first during embryonic development **[UP CPMT 2006]**

- (A) Ectoderm (B) Mesoderm (C) Endoderm (D) Both (A) and (C)

Q.187 Acrosome of spermatozoa is formed from **[MP PMT 2004]**

- (A) Lysosomes (B) Golgi bodies (C) Ribosome (D) Mitochondria

Q.188 The whole nervous system including neuron in frog and other vertebrates is derived from **[MP PMT 2006]**

- (A) Ectoderm (B) Endoderm (C) Mesoderm (D) All of these

Q.189 The cavity, which formed during gastrulation is named **[MP PMT 2007]**

- (A) Blastocoel (B) Archenteron (C) Coelom (D) Pseudocoel

Q.190 In a sperm, the mitochondria occur **[MP PMT 2001]**

- (A) In tail (B) In acrosome (C) In middle piece (D) In head

- Q.191** Identical twins will be produced when **[MP PMT 2001]**
- (A) One spermatozoon fertilizes two ova
(B) One ovum is fertilized by two spermatozoa
(C) Two eggs are fertilized
(D) One fertilized egg divides into two blastomeres and they become separate
- Q.192** Which set of enzymes is found in the acrosome of mammalian spermatozoa **[MP PMT 2001]**
- (A) Hyaluronidase, Corona Penetrating Enzyme (CPE)
(B) Hyaluronidase, CPE, Zona lysine
(C) Hyaluronidase, CPE, Peptidase
(D) Hyaluronidase only
- Q.193** Fixing up of the blastocyst in the wall of the uterus is known as **[MP PMT 2002]**
- (A) Fertilization (B) Implantation (C) Impregnation (D) Placentation
- Q.194** The type of placenta found in human beings is of type **[MP PMT 2002]**
- (A) Diffuse (B) Zonary (C) Cotyledonary (D) Discoidal
- Q.195** Placenta in human beings is formed by **[MP PMT 2002]**
- (A) Amnion (B) Chorion
(C) Allantois (D) Allantois, chorion and uterine wall
- Q.196** The phenomenon of nuclear fusion of sperm and egg is known as **[MP PMT 2002]**
- (A) Karyogamy (B) Parthenogenesis
(C) Vitellogenesis (D) Oogenesis
- Q.197** Cleidoic eggs are characteristic of **[MP PMT 2002]**
- (A) Mammals (B) Reptiles, Birds and Insects
(C) Insects only (D) Fishes
- Q.198** Archenteron cavity is found in **[MP PMT 2002]**
- (A) In Blastula (B) In Gastrula
(C) In Morula (D) In Planula

ANSWER KEY**Objective Questions**

Q.1 B	Q.2 D	Q.3 C	Q.4 A	Q.5 B	Q.6 A
Q.7 A	Q.8 D	Q.9 C	Q.10 A	Q.11 C	Q.12 A
Q.13 C	Q.14 A	Q.15 C	Q.16 B	Q.17 B	Q.18 B
Q.19 C	Q.20 A	Q.21 B	Q.22 D	Q.23 C	Q.24 A
Q.25 C	Q.26 B	Q.27 C	Q.28 A	Q.29 D	Q.30 C
Q.31 B	Q.32 B	Q.33 D	Q.34 C	Q.35 D	Q.36 A
Q.37 B	Q.38 B	Q.39 C	Q.40 C	Q.41 C	Q.42 C
Q.43 B	Q.44 A	Q.45 D	Q.46 B	Q.47 C	Q.48 D
Q.49 B	Q.50 B	Q.51 B	Q.52 B	Q.53 C	Q.54 C
Q.55 B	Q.56 A	Q.57 D	Q.58 B	Q.59 D	Q.60 B
Q.61 B	Q.62 C	Q.63 B	Q.64 A	Q.65 D	Q.66 C
Q.67 D	Q.68 B	Q.69 C	Q.70 A	Q.71 D	Q.72 B
Q.73 B	Q.74 D	Q.75 C	Q.76 A	Q.77 B	Q.78 A
Q.79 C	Q.80 B	Q.81 C	Q.82 A	Q.83 B	Q.84 B
Q.85 B	Q.86 D	Q.87 C	Q.88 C	Q.89 D	Q.90 C
Q.91 B	Q.92 B	Q.93 C	Q.94 B	Q.95 D	Q.96 A
Q.97 A	Q.98 B	Q.99 B	Q.100 C	Q.101 C	Q.102 A
Q.103 A	Q.104 B	Q.105 D	Q.106 C	Q.107 B	Q.108 C
Q.109 D	Q.110 B	Q.111 B	Q.112 D	Q.113 B	Q.114 D
Q.115 D	Q.116 B	Q.117 B	Q.118 C	Q.119 B	Q.120 C
Q.121 A	Q.122 C	Q.123 C	Q.124 C	Q.125 C	Q.126 D
Q.127 A	Q.128 C	Q.129 C	Q.130 C	Q.131 D	Q.132 C
Q.133 A	Q.134 C	Q.135 C	Q.136 C	Q.137 B	Q.138 A
Q.139 C	Q.140 B	Q.141 B	Q.142 C	Q.143 C	Q.144 D
Q.145 A	Q.146 C	Q.147 A	Q.148 C	Q.149 D	Q.150 D

Q.151 B	Q.152 B	Q.153 C	Q.154 B	Q.155 B	Q.156 C
Q.157 D	Q.158 D	Q.159 D	Q.160 D	Q.161 C	Q.162 C
Q.163 A	Q.164 D	Q.165 C	Q.166 B	Q.167 D	Q.168 D
Q.169 B	Q.170 A	Q.171 B	Q.172 D	Q.173 A	Q.174 D
Q.175 B	Q.176 C	Q.177 B	Q.178 A	Q.179 D	Q.180 B
Q.181 B	Q.182 D	Q.183 A	Q.184 A	Q.185 D	Q.186 A
Q.187 A	Q.188 C	Q.189 C	Q.190 C	Q.191 D	Q.192 B
Q.193 B	Q.194 B	Q.195 C	Q.196 B	Q.197 B	Q.198 A
Q.199 B	Q.200 A	Q.201 C	Q.202 C	Q.203 D	Q.204 B
Q.205 C	Q.206 C	Q.207 B	Q.208 D	Q.209 B	Q.210 D
Q.211 B	Q.212 B	Q.213 D	Q.214 C	Q.215 D	Q.216 D
Q.217 C	Q.218 A	Q.219 D	Q.220 A	Q.221 C	Q.222 C
Q.223 A	Q.224 C	Q.225 C	Q.226 C	Q.227 D	Q.228 A
Q.229 A	Q.230 C	Q.231 A	Q.232 A	Q.233 A	Q.234 D
Q.235 B	Q.236 C	Q.237 A	Q.238 C	Q.239 A	Q.240 B
Q.241 A	Q.242 B	Q.243 B	Q.244 B	Q.245 D	Q.246 A
Q.247 A	Q.248 B	Q.249 C	Q.250 A	Q.251 A	Q.252 C
Q.253 A	Q.254 B	Q.255 A			

Previous Years' Questions

Q.1 A	Q.2 B	Q.3 C	Q.4 C	Q.5 C	Q.6 D
Q.7 A	Q.8 C	Q.9 C	Q.10 A	Q.11 D	Q.12 D
Q.13 C	Q.14 C	Q.15 C	Q.16 B	Q.17 C	Q.18 A
Q.19 D	Q.20 A	Q.21 B	Q.22 D	Q.23 A	Q.24 B
Q.25 C	Q.26 A	Q.27 D	Q.28 D	Q.29 C	Q.30 A
Q.31 C	Q.32 C	Q.33 A	Q.34 D	Q.35 D	Q.36 D
Q.37 A	Q.38 A	Q.39 A	Q.40 D	Q.41 C	Q.42 B
Q.43 D	Q.44 A	Q.45 B	Q.46 A	Q.47 D	Q.48 C
Q.49 B	Q.50 A	Q.51 B	Q.52 B	Q.53 A	Q.54 D

Q.55 B	Q.56 B	Q.57 B	Q.58 D	Q.59 A	Q.60 C
Q.61 B	Q.62 C	Q.63 C	Q.64 A	Q.65 B	Q.66 A
Q.67 B	Q.68 D	Q.69 B	Q.70 C	Q.71 A	Q.72 C
Q.73 C	Q.74 C	Q.75 B	Q.76 B	Q.77 B	Q.78 D
Q.79 C	Q.80 A	Q.81 C	Q.82 C	Q.83 C	Q.84 B
Q.85 C	Q.86 A	Q.87 C	Q.88 B	Q.89 C	Q.90 A
Q.91 A	Q.92 C	Q.93 A	Q.94 B	Q.95 C	Q.96 B
Q.97 D	Q.98 C	Q.99 D	Q.100 C	Q.101 C	Q.102 B
Q.103 D	Q.104 A	Q.105 C	Q.106 D	Q.107 D	Q.108 D
Q.109 D	Q.110 A	Q.111 B	Q.112 C	Q.113 C	Q.114 A
Q.115 D	Q.116 B	Q.117 A	Q.118 B	Q.119 C	Q.120 B
Q.121 D	Q.122 B	Q.123 B	Q.124 B	Q.125 A	Q.126 D
Q.127 B	Q.128 B	Q.129 A	Q.130 C	Q.131 A	Q.132 C
Q.133 B	Q.134 B	Q.135 C	Q.136 B	Q.137 B	Q.138 B
Q.139 A	Q.140 D	Q.141 A	Q.142 D	Q.143 A	Q.144 A
Q.145 C	Q.146 C	Q.147 D	Q.148 D	Q.149 D	Q.150 C
Q.151 B	Q.152 B	Q.153 A	Q.154 A	Q.155 C	Q.156 D
Q.157 B	Q.158 B	Q.159 C	Q.160 A	Q.161 A	Q.162 A
Q.163 B	Q.164 A	Q.165 A	Q.166 B	Q.167 D	Q.168 B
Q.169 D	Q.170 B	Q.171 A	Q.172 A	Q.173 D	Q.174 A
Q.175 D	Q.176 A	Q.177 C	Q.178 D	Q.179 A	Q.180 A
Q.181 C	Q.182 D	Q.183 D	Q.184 C	Q.185 C	Q.186 C
Q.187 B	Q.188 A	Q.189 B	Q.190 C	Q.191 D	Q.192 B
Q.193 B	Q.194 D	Q.195 D	Q.196 A	Q.197 B	Q.198 B