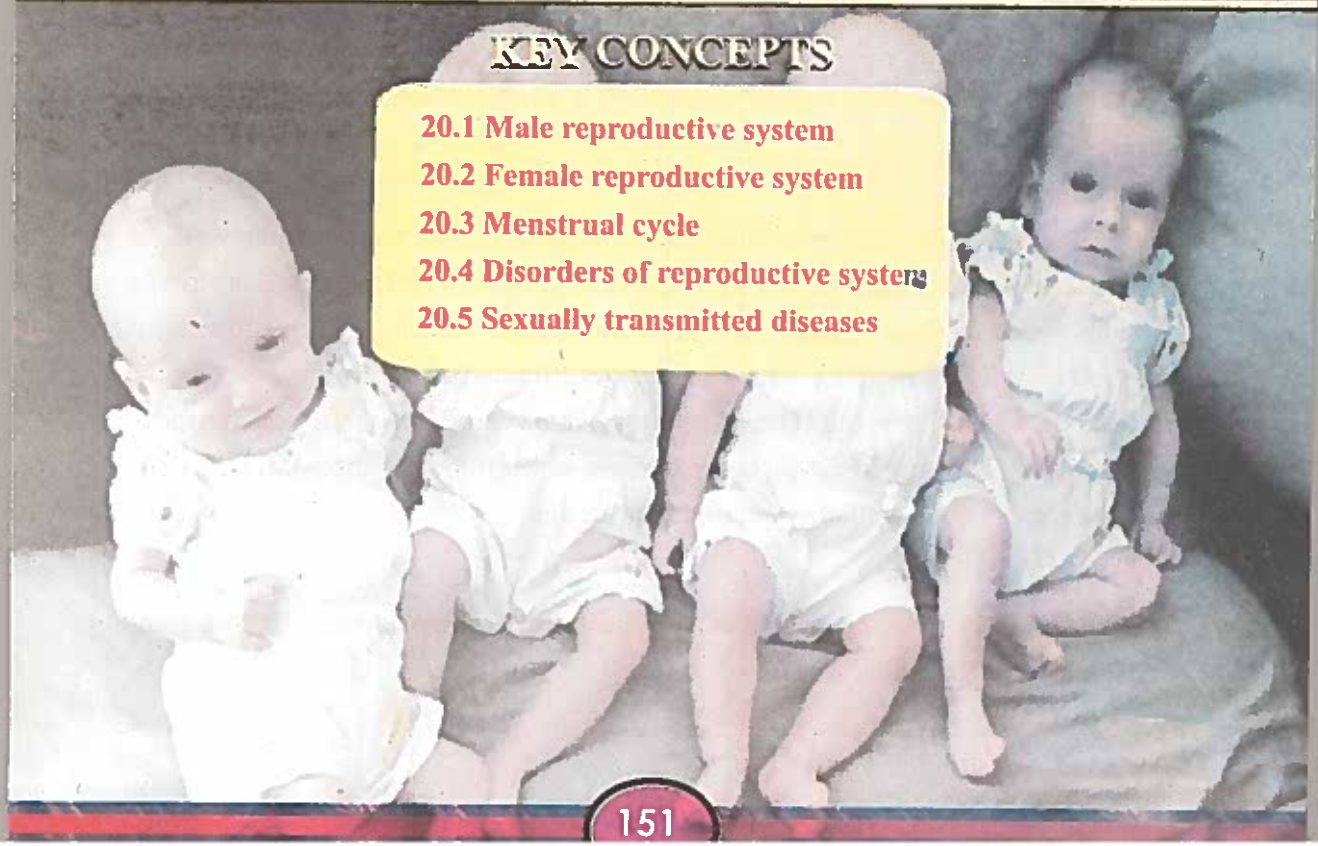
UNIT

20

REPRODUCTION

KEY CONCEPTS

20.1 Male reproductive system
20.2 Female reproductive system
20.3 Menstrual cycle
20.4 Disorders of reproductive system
20.5 Sexually transmitted diseases



Reproduction is important for the survival of all living things. Without a mechanism for reproduction, life comes to an end. Reproduction guarantees the transmission of one generation's genetic material into the next generation. Without this transmission, the species will cease to exist after all of the members of the current generation have died out. Thus, reproduction is essential to the continued survival of a species over time.

HUMAN REPRODUCTIVE SYSTEM

The humans are the most advanced mammals and correspondingly show a reproductive pattern, which is most efficient, especially in the sense of protection of the embryo within the female body as well as its care after its birth. The male and female reproductive system in humans is as follows.

20.1 MALE REPRODUCTIVE SYSTEM

Male reproductive system consists of a pair of testes, ducts, glands, and external genitalia.

20.1.1 Testes:

The testes are male gonads which are situated outside the abdomen within a skin pouch called scrotum. Each testis is divided into 250 to 300 lobules. Each lobule contains one to four tightly coiled seminiferous tubules. The process of spermatogenesis takes place here in the seminiferous tubules. Leyden cells are present between the seminiferous tubules which produce male sex hormone testosterone. The accessory ducts include the vasa efferentia, the epididymis, the ductus deferens, the ejaculatory duct, and the urethra.

20.1.2 Vasa efferentia:

About 10 to 20 vasa efferentia collect sperms from inside the testes and transfer them to the epididymis.

The epididymis rests on the backside of each testis. Most of the epididymis consists of the highly coiled duct of the epididymis with an uncoiled length of about 6 m (20 feet). Its functions are the transport and storage of the sperms. Here the sperms are stored temporarily, nourished, and they gain the ability to swim.

20.1.4 Vas deferens:

It starts from the epididymis moves deep into the pelvic cavity and then joins with the duct of the seminal vesicle to form the short ejaculatory duct. Each ejaculatory duct enters the prostate; there it empties into the urethra.

20.1.5 Urethra:

The urethra is the terminal portion of the male duct system. It opens to the outside at the external urethral orifice and conveys both urine and semen.

20.1.6 Accessory glands:

The Seminal Vesicles provide an alkaline fluid containing fructose sugar, ascorbic acid, and a coagulating enzyme called vesiculase, as well as other substances that enhance sperm motility thus improve their fertilizing power.

DO YOU KNOW?

Why the testes are located outside the abdominal cavity? The testes work best at temperatures slightly less than core body temperature. The optimum temperature for sperm development is about 35 °C.

The Prostate encircles the urethra just below the bladder. Its secretion is a milky, slightly acidic fluid that contains citrate as a nutrient source and several enzymes especially hyaluronidase.Cowpers' gland secretes mucus and an alkaline fluid into the urethra. The alkaline fluid neutralizes the acidity of urine in the urethra.The Bulbourethral Glands produce thick and clear mucus.

Semen is a white, sticky mixture of sperm and secretions of accessory glands. The liquid substance in the semen provides nutrients and protection to sperms and acts as a transport medium for sperms. Prostaglandins in semen decrease the viscosity of mucus guarding the entry (cervix) of the uterus and stimulate reverse peristalsis in the uterus, facilitating sperm movement through the female reproductive tract.

20.1.6 Spermatogenesis:

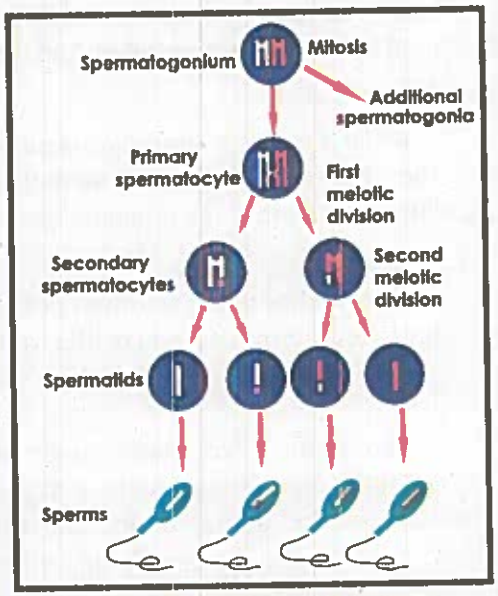


Fig: 20.3 Spermatogenesis.

It is the process of sperm formation in males which involves a precise sequence of events. This process takes place in semniferous tubules. Spermatogonia are the outermost cells which make the epithelial wall of the semniferous tubules. These cells are just beneath the basal lamina. The spermatogonia divide continuously by mitosis and, each mitotic division of a spermatogonium results in two distinctive daughter cells–types A and B.

The type A daughter cell remains at the basement membrane to maintain the germ cell line. The type B cell gets pushed toward the lumen, where it becomes a primary spermatocyte destined to produce four sperm.

Each primary spermatocyte undergoes meiosis I, forming two smaller haploid cells called secondary spermatocytes.

The secondary spermatocytes continue on rapidly into meiosis II, and their daughter cells, called spermatids are formed. Each spermatid is a round, nonmotile haploid cell.

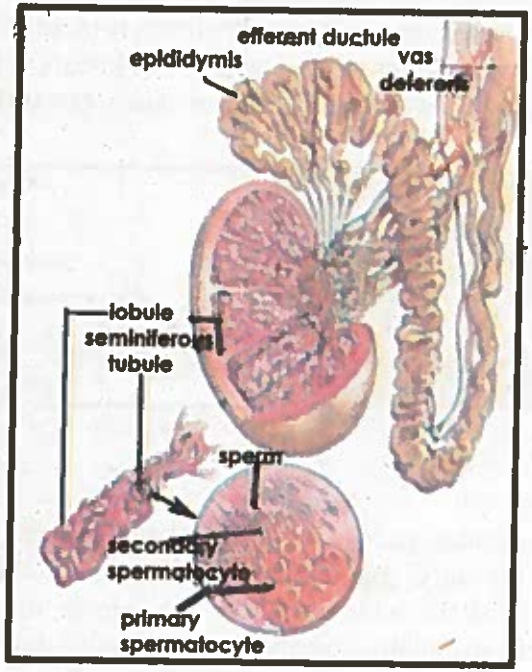


Fig: 20.4 Section through testis showing the site of sperm production.

Spermiogenesis is a process in which spermatids change into motile and active sperms. During this process a spermatid elongates, sheds its excess cytoplasm, and forms a tail.

20.1.7 Sperm:

The sperm, or spermatozoon (animal seed), is a very small haploid cell. It has a head, a neck, a midpiece, and a tail. The head contains the nucleus having haploid set of chromosome. Adhering to the top of the head is acrosome. The lysosome-like acrosome is produced by the Golgi apparatus and contains hydrolytic enzyme hyaluronidase that enables the sperm to penetrate and enter an egg. The neck of sperm is very short and contains a pair of centrioles. The microtubules of one of the

centriole elongate and run the entire length of the tail. It forms the axial filament of the tail. The middle piece contains many mitochondria arranged spirally around the axial filament. The process begins around the age of 14 years in males, and continues throughout life. Every day, a healthy adult male makes about 400 million sperm.

Fig: 20.5 Structure of a sperm

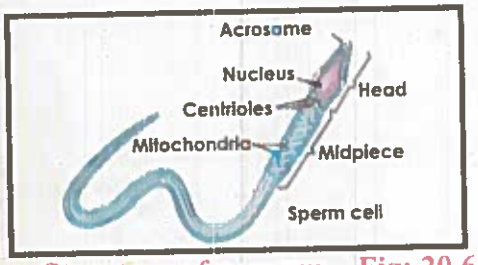


Fig: 20.6

20.1.8 Hormonal control:

Process of spermatogenesis is controlled by hormonal secretions from hypothalamus and pituitary gland. The hypothalamus releases gonadotropin-releasing hormone (GnRH), which controls the release of the anterior pituitary gonadotropins follicle-stimulating hormone (FSH) and luteinizing hormone (LH). FSH stimulates spermatogenesis by stimulating the sertoli cells (cell of the testes that is part of a seminiferous tubule) to complete the development of sperms from spermatids. LH stimulates leydig cells (found adjacent to the seminiferous tubules in the testicle) to release testosterone. Testosterone causes the growth and development of germinal epithelium to form sperms.

Inhibin hormone is produced by the sertoli cells and serves to control the spermatogenesis at normal rate. When the sperm count is high, inhibin release increases and it inhibits anterior pituitary release of FSH and hypothalamic release of GnRH. When sperm count falls, inhibin secretion declines steeply.

20.2 FEMALE REPRODUCTIVE SYSTEM

The reproductive role of the female is far more complex than that of a male. Not only must she produce gametes, but her body must prepare to nurture a developing embryo for a period of approximately nine months. Female reproductive system consists of a pair of ovaries, oviducts, uterus, cervix, and vagina.

20.2.1 Ovaries:

Ovaries are female gonads which produce ova and release hormones. The paired ovaries flank the uterus on each side and each ovary is held in place within the

peritoneal cavity by several ligaments. The ovaries are almond-shaped, measure about 3-5 cm long and 2-3 cm wide. Within the ovary are many tiny saclike structures called ovarian follicles each of which consists of an immature egg, called an oocyte. Each month in adult women, one of the ripening follicles ejects its oocyte from the ovary. This event is called ovulation. After ovulation, the ruptured follicle is transformed into a glandular structure called the corpus luteum.

20.2.2 Fallopian tubes:

Fallopian tubes or oviducts form the initial part of the female duct system. They receive the ovulated oocyte and are the site where fertilization generally occurs. Each oviduct is about 10 cm long and extends near from the region of an ovary to empty into the uterus. The uterine tube contains sheets of smooth muscle and contains both ciliated and non-ciliated cells. The oocyte is carried toward the uterus by a combination of muscular peristalsis and the beating of the cilia. Non-ciliated cells produce a secretion that keeps the oocyte (and sperm, if present) moist and nourished.

20.2.3 Uterus:

The uterus is located in the pelvis, anterior to the rectum and posterior to the bladder. It is about the size and shape of an inverted pear. It is a hollow, thick-walled, muscular organ that functions to receive, retain, and nourish a fertilized ovum. The wall of the uterus is composed of three layers. The **perimetrium** is the outermost thin covering layer of the uterus. The **myometrium** is the middle thick muscular layer composed of bundles of smooth muscle, that contracts rhythmically during childbirth to expel the baby from the mother's body.

The **endometrium** is the inner spongy lining of the uterine cavity. If fertilization occurs, the young embryo takes root into the endometrium (implants) and resides there for the rest of its development.

20.2.4 Cervix:

It is a narrow entrance to the uterus from the vagina. It is normally blocked by a plug of mucus.

20.2.5 Vagina:

The vagina is a thin-walled 8–10 cm long tube and extends from the cervix to the body exterior.

It is often called the birth canal as it provides a passageway for delivery of an infant and for menstrual flow. The urethra is embedded in its anterior wall.

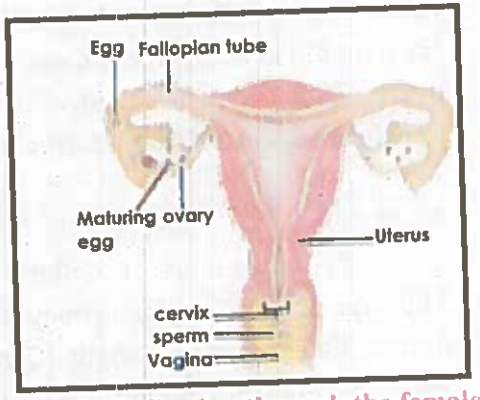


Fig: 20.7 Section through the female reproductive system.

20.2.6 Oogenesis:

The process of egg formation in females is called oogenesis. The process of oogenesis takes years to complete. First, in the fetal period the oogonia, the diploid stem cells of the ovaries, multiply rapidly by mitosis and then enter a growth phase and lay in nutrient reserves. Gradually the oogonia are transformed into primary oocytes and become surrounded by a single layer of follicle cells. The primary oocytes begin the first meiotic division, but become "stalled" late in prophase I and do not complete it. They remain in their state of suspended animation all through childhood; the wait is a long one–10 to 14 years at the very least!

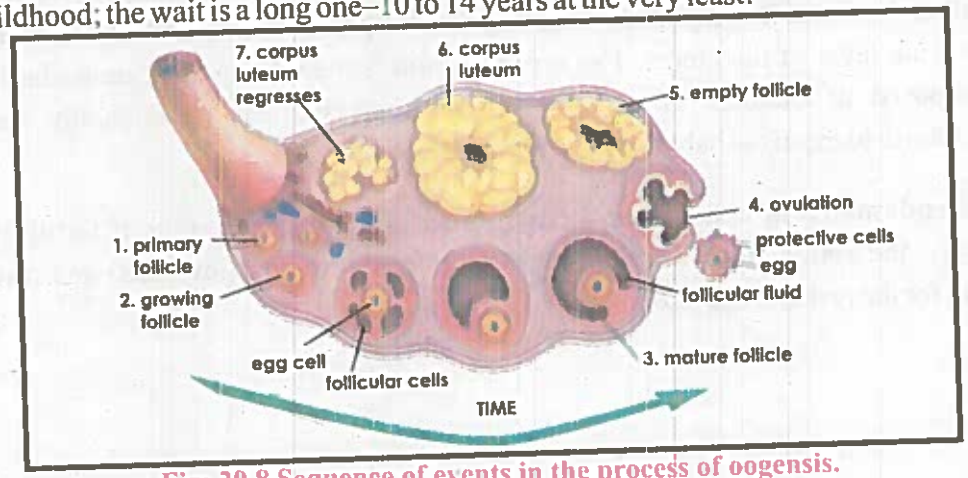


Fig: 20.8 Sequence of events in the process of oogensis.

At puberty, a small number of primary oocytes are recruited each month, however, only one is selected each time to continue meiosis I, ultimately producing two haploid cells (that are quite dissimilar in size. The larger cell, which contains nearly all the cytoplasm of the primary oocyte, is the secondary oocyte. The smaller cell is called the first polar body.

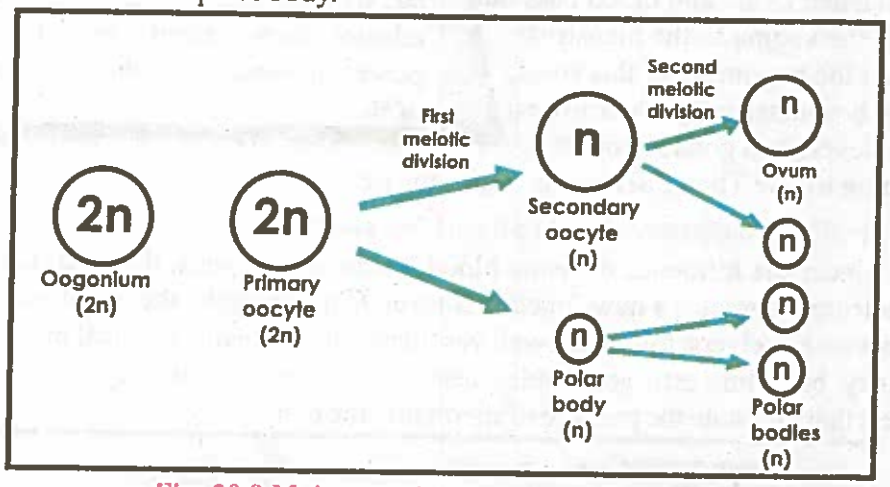


Fig: 20.9 Main steps in the process of oogensis.

In humans, the secondary oocyte arrests in metaphase II and it is this cell that is ovulated. If an ovulated secondary oocyte is not penetrated by a sperm, it simply deteriorates. But, if sperm penetration does occur, it quickly completes meiosis II, yielding one large ovum and a tiny second polar body. The unequal cytoplasmic divisions that occur during oogenesis ensure that a fertilized egg has ample nutrients for its six- to seven-day journey to the uterus. Without nutrient-containing cytoplasm the polar bodies degenerate and die.

20.3 MENSTRUAL CYCLE

The reproductive cycle in human and other primates is called menstrual cycle. The first menstruation begins at puberty. The uterine or menstrual cycle is a series of cyclic changes that the uterine endometrium goes through each month as it responds to the waxing and waning of ovarian hormones in the blood. These endometrial changes are coordinated with the phases of the ovarian cycle, which are controlled by gonadotropins released by the anterior pituitary.

Various phases of menstrual cycle are as follows:

20.3.1 Menstrual phase (Days 1–5): In this menstruation phase, the uterus sheds all but the deepest part of its endometrium.

The thick, hormone-dependent functional layer of the endometrium detaches from the uterine wall, a process that is accompanied by bleeding for 3–5 days. The detached tissue and blood pass out through the vagina as the menstrual flow. At the beginning of this stage, ovarian hormones are at their lowest normal levels and gonadotropins are beginning to rise.Then FSH levels begin to rise.

For Your Information

.It has been assumed that a female's total supply of eggs is already determined by the time she is born, and the time span during which she releases them extends only from puberty to menopause, about the age of 50.

20.3.2 Proliferative/preovulatory phase (Days 6–14):

Under the influence of rising blood levels of estrogens, the basal layer of the endometrium generates a new functional layer. Consequently, the endometrium once again becomes velvety, thick, and well vascularized. Normally, cervical mucus is thick and sticky, but rising estrogen levels cause it to thin and become crystalline, forming channels that facilitate the passage of sperm into the uterus.

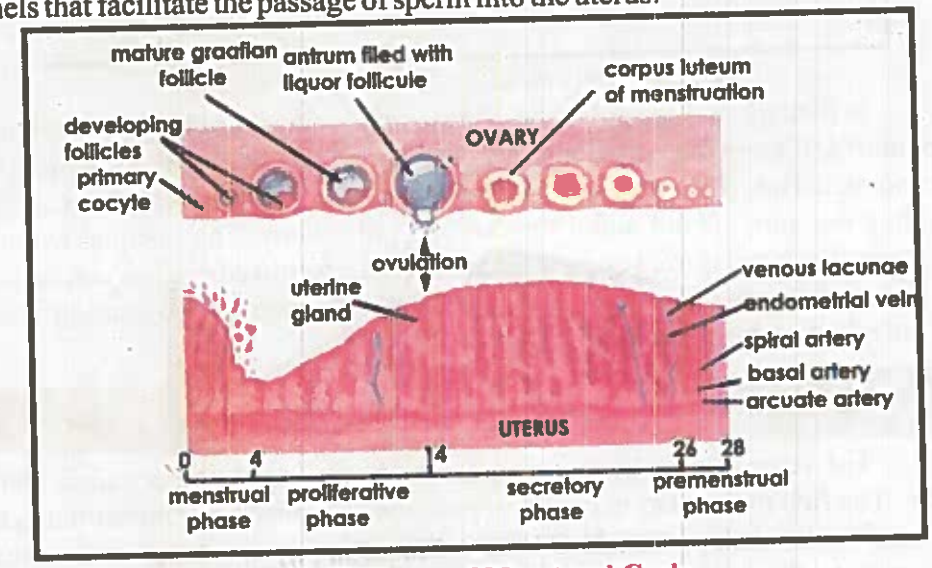


Fig: 20.10 Phases of Menstrual Cycle.

Ovulation, which takes less than five minutes, occurs in the ovary at the end of the proliferative stage (day 14) in response to the sudden release of LH from the anterior pituitary. LH also converts the ruptured follicle to a corpus luteum.

20.3.3 Secretory/postovulatory phase (Days 15–28):

This 14-day phase is the most important. During the secretory phase the

endometrium prepares for implantation of an embryo. Rising levels of progesterone from the corpus luteum act on the estrogen-primed endometrium, causing the arteries to elaborate and converting the functional layer to a glandular secretory layer. The uterine glands enlarge, coil, and begin secreting nutritious glycogen into the uterine cavity. These nutrients sustain the embryo until it has implanted in the blood-rich endometrial lining.

If fertilization has not occurred, the corpus luteum begins to degenerate toward the end of the secretory phase as LH blood levels decline. Progesterone levels fall, depriving the endometrium of hormonal support, and endometrial cells die, setting the stage for menstruation to begin on day 28.

In female menstrual cycle ceases around 50 year of age and it is termed as menopause. Cyclic menstruation is an indicator of normal reproductive life of females.

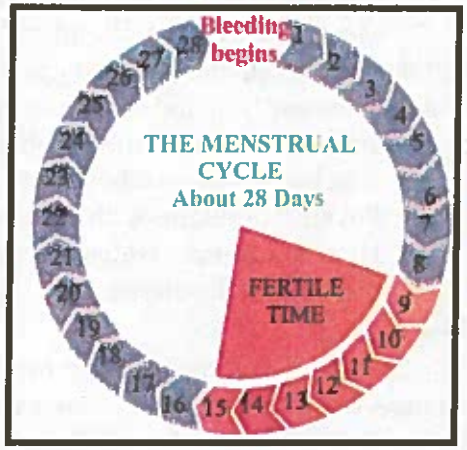


Fig: 20.11

For Your Information

In 1–2% of all ovulations, more than one oocyte is ovulated. This phenomenon, which increases with age, can result in multiple births. Since, in such cases, different oocytes are fertilized by different sperm, the siblings are fraternal, or nonidentical, twins. Identical twins result from the fertilization of a single oocyte by a single sperm, followed by separation of the fertilized egg's daughter cells in early development

20.4 DISORDERS OF REPRODUCTIVE SYSTEM

20.4.1 Female infertility

Infertility means not being able to get pregnant. Women who can get pregnant but are unable to stay pregnant may also be infertile.

Pregnancy is the result of a process that has many steps. To get pregnant:

- A woman's body must release an egg from one of her ovaries (ovulation).
- The egg must go through a fallopian tube toward the uterus.
- A man's sperm must join with (fertilize) the egg along the way.
- The fertilized egg must attach to the inside of the uterus (implantation).
- Infertility can happen if there are problems with any of these steps.

Most cases of female infertility are caused by problems with ovulation. Without ovulation, there are no eggs to be fertilized. Some signs that a woman is not ovulating normally include irregular or absent menstrual periods.

Less common causes of fertility problems in women include:

- Blocked fallopian tubes due to pelvic inflammatory disease, endometriosis
- Physical problems with the uterus
- Uterine fibroids, which are non-cancerous clumps of tissue and muscle on the walls of the uterus.

20.4.2 Male Infertility:

Infertility in men is most often caused by a problem called varicocele. This happens when the veins on a man's testes are too large. This heats the testicles. The heat can affect the number or shape of the sperm. Other factors that cause a man to make too few sperm or none at all.

Movement of the sperm is yet another cause infertility. This may be caused by the shape of the sperm. Sometimes injuries or other damage to the reproductive system block the sperm. Sometimes a man is born with the problems that affect his sperm. Other times problems start later in life due to illness or injury. For example, cystic fibrosis often causes infertility in men.

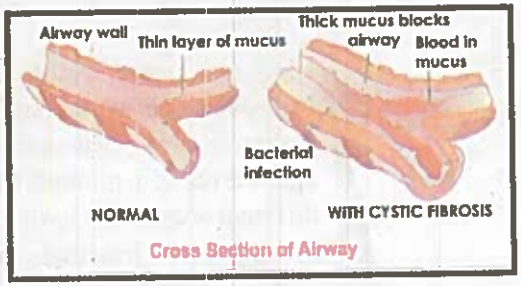


Fig:20.12 Cystic Fibrosis, is an autosomal recessive genetic disorder that affects most critically the lungs, and also the pancreas, liver, and intestine.

20.4.3 In vitro fertilization (IVF):

IVF means fertilization outside of the body. IVF is the most effective types of assisted reproductive technology. It is often used when a woman's fallopian tubes are blocked or when a man produces too few sperm. Doctors treat the woman with hormones that causes the ovaries to produce multiple eggs. Once mature, the eggs are removed from the woman. They are put in a dish in the lab along with the man's sperm for fertilization. After 3 to 5 days, healthy embryos are implanted in the woman's uterus.

20.4.4 Miscarriage:

A miscarriage is the spontaneous loss of a foetus before the 20th week of pregnancy. (Pregnancy losses after the 20th week are called preterm deliveries.) A miscarriage may also be called a "spontaneous abortion." This refers to naturally occurring events, not medical abortions. Most miscarriages are caused by chromosome problems that make it impossible for the baby to develop. Usually, these problems are unrelated to the mother or father's genes.

Other possible causes for miscarriage include: Drug and alcohol abuse, exposure to environmental toxins, hormone problems, infections, obesity, physical problems with the mother's reproductive organs, problem with the body's immune response, serious body-wide diseases in the mother such as uncontrolled diabetes and smoking. It is estimated that up to half of all fertilized eggs die and are lost (aborted) spontaneously, usually before the woman knows she is pregnant. Among those women who know they are pregnant, the miscarriage rate is about 15-20%. Most miscarriages occur during the first 7 weeks of pregnancy.

Abortion is defined as the termination of pregnancy by the removal or expulsion of a foetus or embryo from the uterus before it is viable. An abortion can occur spontaneously, in which case it is usually called a miscarriage, or it can be purposely induced. The term abortion most commonly refers to the induced abortion of a human pregnancy.

20.5 SEXUALLY TRANSMITTED DISEASES

20.5.1 Gonorrhea:

The causative agent of gonorrhea is *Neisseria gonorrhoeae*, which invades the mucosae of the reproductive and urinary tracts.The most common symptom of gonorrhea in males is urethritis, accompanied by painful urination and discharge of pus from the penis.

Symptoms vary in women, ranging from none (about 20% of cases) to abdominal discomfort, vaginal discharge, abnormal uterine bleeding, and occasionally, urethral symptoms similar to those seen in males. Untreated gonorrhea can cause urethral constriction and inflammation of the entire male duct system. In women, it causes pelvic inflammatory disease and sterility. It can be treated by penicillin, tetracycline, and certain other antibiotics.

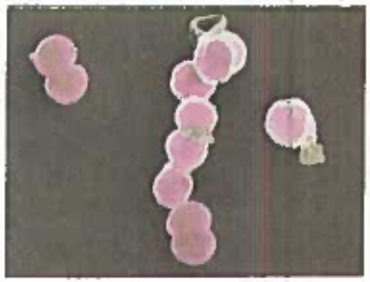


Fig:20.13 *Neisseria gonorrhoeae*,

20.5.2 Syphilis:

Syphilis is caused by *Treponema pallidum*, and is usually transmitted sexually, but it can be contracted congenitally from an infected mother. Foetuses infected with syphilis are usually stillborn or die shortly after birth. The bacterium easily penetrates intact mucosae and abraded skin.

Within a few hours of exposure, an asymptomatic body wide infection is in progress. After an incubation period of two to three weeks, a red, painless primary lesion called a chancre (shang'ker) appears at the site of bacterial invasion. In males, this is typically the penis, but in females the lesion often goes undetected within the vagina or on the cervix. The chancre ulcerates and becomes crusty; then it heals spontaneously and disappears within a few weeks.

If syphilis is untreated, its secondary signs appear several weeks later. A pink skin rash all over the body is one of the first symptoms. Fever and joint pain are common. These signs and symptoms disappear spontaneously in three to twelve weeks. Then the disease enters the latent period and is detectable only by a blood test. The latent stage may last a person's lifetime (or the bacteria may be killed by the immune system), or it may be followed by the signs of tertiary syphilis. Tertiary syphilis is characterized by gummas, destructive lesions of the CNS, blood vessels, bones, and skin. Penicillin is still the treatment of choice for all stages of syphilis.

20.5.3 AIDS

AIDS is one of the most serious, deadly diseases in human history. More than 20 years ago, doctors in the United States identified the first cases of AIDS in San Francisco and New York. Now there are an estimated 42 million people living with HIV or AIDS worldwide, and more than 3 million die every year from AIDS-related illnesses. AIDS is caused by the human immunodeficiency virus (HIV). HIV destroys a type of defense cell in the body called a CD4 helper lymphocyte.

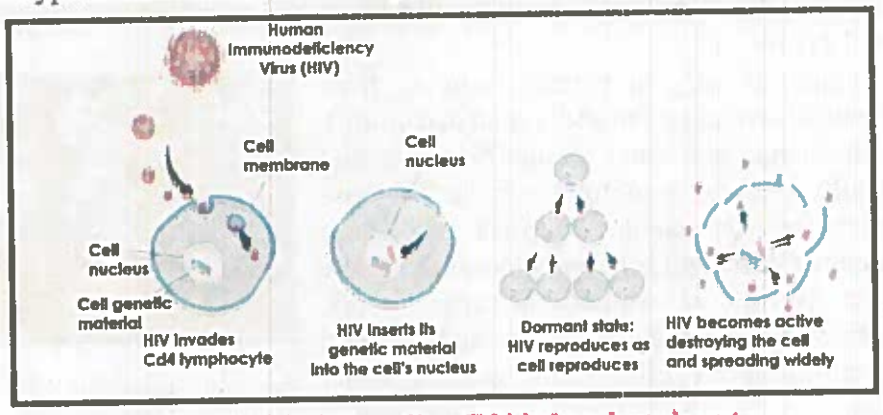


Fig:20.13 HIV invading Cd4 helper lymphocyte

These lymphocytes are part of the body's immune system, the defence system that fights infectious diseases. But as HIV destroys these lymphocytes, people with the virus begin to get serious infections that they normally wouldn't — that is, they become immune deficient. The name for this condition is acquired immunodeficiency syndrome (AIDS).

As the medical community learns more about how HIV works, they've been able to develop drugs to inhibit it (meaning they interfere with its growth). These drugs have been successful in slowing the progress of the disease, and people with the disease now live much longer. But there is still no cure for HIV and AIDS.

HIV can be transmitted from an infected person to another person through blood, semen vaginal fluids, and breast milk.

The virus is spread through high-risk behaviors including; immoral sexual behaviour, sharing needles, such as needles used to inject drugs, needles used for injecting steroids and those used for tattooing.

People who have another sexually transmitted disease, such as syphilis, genital herpes, gonorrhea, or bacterial vaginosis are at greater risk for getting HIV.

If a woman with HIV is pregnant, her newborn baby can catch the virus from her before birth, during the birth process, or from breast feeding.

Fig:20.15 Needles used in tatto art can be an agent for HIV infection.

KEY POINTS

- Reproduction guarantees the transmission of one generation's genetic material into the next generation.
- Male reproductive system consists of a pair of testes, ducts, glands, and external genitalia.
- Each testis is divided into 250 to 300 lobules. Each lobule contains one to four tightly coiled seminiferous tubules. The process of spermatogenesis takes place here in the seminiferous tubules.
- The Prostate gland produce a secretion which is a milky, slightly acidic fluid that contains citrate as a nutrient source and several enzymes.
- Cowpers' gland secretes mucus and an alkaline fluid into the urethra. The alkaline fluid neutralizes the acidity of urine in the urethra.
- The Bulbourethral glands produce thick and clear mucus. Some of the mucus drains into the urethra when a man becomes sexually excited and neutralizes traces of acidic urine in the urethra.
- Semen is a white, sticky mixture of sperm and secretions of accessory glands.
- Spermatogenesis is initiated in the male testis with the beginning of puberty. This comprises the entire development of the spermatogonia (former primordial germ cells) up to sperm cells.
- Process of spermatogenesis is controlled by hormonal secretions from hypothalamus and pituitary gland.
- Female reproductive system consists of a pair of ovaries, oviducts, uterus, cervix, and vagina.
- Within the ovary are many tiny saclike structures called ovarian follicles each of which consists of an immature egg, called an oocyte.
- Each month in adult women, one of the ripening follicles ejects its oocyte from the ovary. This event is called ovulation.
- The process of egg formation in females is called oogenesis.
- The reproductive cycle in human and other primates is called menstrual cycle.
- In female menstrual cycle ceases around 50 year of age and it is termed as menopause. Cyclic menstruation is an indicator of normal reproductive life of females.

KEY POINTS

- Most cases of female infertility are caused by problems with ovulation. Without ovulation, there are no eggs to be fertilized. Some signs that a woman is not ovulating normally include irregular or absent menstrual periods.
- IVF is the most effective types of assisted reproductive technology.
- A miscarriage is the spontaneous loss of a foetus before the 20th week of pregnancy.
- The most common symptom of gonorrhea in males is urethritis, accompanied by painful urination and discharge of pus from the penis.
- Foetuses infected with syphilis are usually stillborn or die shortly after birth.
- AIDS is caused by the human immunodeficiency virus (HIV) which destroys a CD4 helper lymphocyte. These lymphocytes are part of the body's immune system.

EXERCISE

1- Multiple Choice Questions

(i) ***Gonadotropin releasing hormone is responsible for the stimulation/release of which hormone?***

(a) LH
(b) Progesterone
(c) Secretin
(d) Insulin

(ii) ***Fertilization of the ovum normally occurs:***

(a) In the upper third of the oviduct
(b) In the uterus
(c) In the lower third of the oviduct
(d) Can take place successfully in vagina

(iii) ***The human egg is swept through the oviduct toward the uterus by***

(a) The beating of the eggs' cilia.
(b) Rhythmic contraction of the oviduct.
(c) Rhythmic contraction of the uterus.
(d) The beating of the cilia in the oviduct.

(iv) ***Embryo implants in the _____ of the uterus***

(a) Perimetrium
(b) Myometrium
(c) Endometrium
(d) Cervix

(v) ***Which will occur as a result of nondescent of the testes?***

(a) Male sex hormones will not be circulated in the body.
(b) Sperm will have no means of exit from the body.
(c) Inadequate blood supply will retard the development of the testes.
(d) Viable sperm will not be produced.

(vi) ***The corpus luteum is formed at the site of***

(a) Fertilization
(b) Ovulation
(c) Menstruation
(d) Implantation

(vii) ***Within the ovary, progesterone is produced by the***

(a) corpus albicans. **(b)** corpus luteum.
(c) tertiary follicles **(d)** primary follicles.

EXERCISE

(viii) The basic difference between spermatogenesis and oogenesis is that

(a) during spermatogenesis two more polar bodies are produced.
(b) the mature ovum is haploid while the sperm is 2n.
(c) spermatogenesis involves mitosis and meiosis, but oogenesis involves meiosis only.
(d) in oogenesis, one mature ovum is produced, and in spermatogenesis four mature sperm are produced.

(ix) The uterine layer which is shed with each monthly cycle is

(a) endometrium. (b) perimetrium.
(c) tunica albuginea. (d) myometrium.

2- Short Questions

(i) List down the functions of glands associated with the male reproductive system.
(ii) What is the role of hormones in the process of spermatogenesis.
(iii) Differentiate between the terms miscarriage and abortion.
(iv) List down control measures against HIV infection.

3- Long Questions

(i) Explain structure and function of male reproductive system.
(ii) Discuss the structure and function of female reproductive system.
(iii) Analyze hormonal control of male reproductive system.
(iv) Discuss various events of menstrual cycle.
(v) What are the causes of male and female infertility? Analyze the possible solution to this problem.

3- Initiating and Planning

- Examine the prepared slides of histology of ovary and draw its microscopic structure.
- Expose the reproductive system of a dissected frog (dissection would be done by the teacher)

EXERCISE 2

4- **Science, Technology, and Society Connections**

- Realize the effect of endocrine disrupting contaminants on the reproductive abilities.
- Become aware of the ethical implications of abortion.
- List the measures that can help to prevent transmission of HIV.

5- **Online Learning**

- www.betterhealth.vic.gov.au
- *www.biology.clc.uc.edu/courses/bio105/reproduc.htm*
- *www.webmd.com/sex-relationships/guide/male-reproductive-system*
- www.innerbody.com