# Unit 4. Reproduction

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**Activity 4.1. Reflective discussion**

As you know, there were people living in Ethiopia or elsewhere thousand years ago and all were passed away but still there are people living there. Why? Though individuals of a species are mortal, life continues from generation to generation. What biological processes are responsible for this?

## 4.1 Introduction to reproduction

**Objectives**

At the end of this section, the student will be able to:

- *appreciate that life perpetuates from generation to*
- *generation through reproduction*

*What is reproduction?*

Reproduction is one of the unique characteristics of life. The ability of organisms to reproduce to form their own kind is the one characteristic that best distinguishes living things from non living matter. Two modes of reproduction are recognized: asexual and sexual. In asexual reproduction, there is only one parent and with no special reproductive organs or cells. Each organism is capable of producing identical copies

of itself as soon as it becomes an adult. Sexual reproduction as a rule involves two parents, each of which contributes special germ cells (egg or sperm) that in union (fertilization) develop into a new individual.

## 4.2 Asexual reproduction

**Objectives**

At the end of this section, the student will be able to:

- *define asexual reproduction*
- *differentiate the process of asexual reproduction*
- *tell the advantages and disadvantages of asexual reproduction*

*What is common to all types of asexual reproduction?*

Asexual reproduction is the production of individuals without gametes (eggs or sperm). It includes a number of distinct processes, all without involving sex or a second parent. Asexual reproduction appears in bacteria and unicellular eukaryotes and in many invertebrates, fungi and plants. However, asexual reproduction is absent among vertebrates. The basic forms of asexual reproduction are fission (binary and multiple), budding, and fragmentation. For example, a small piece of stem planted in the soil may form roots and grow into a complete plant (Fig.4.1).

Asexual reproduction has couple of advantages - no mate is needed; no gametes are needed; all the good characteristics of the parent are passed on to the offspring; and offspring will grow in the same favourable environment as the parent. Plants that reproduce asexually usually store large amounts of food that allow survival. The disadvantages are there is little variation created, so adaptation to a changing environment (evolution) is unlikely. If the parent has no resistance to a particular disease, none of the offspring will have resistance. Lack of dispersal can lead to competition for nutrients, water and light.


Figure 4.1. Vegetative propagation in plants

**Activity 4.2: Concept mapping**

No organism can live forever, but part of it lives in its offspring. Offspring are produced by the process of reproduction. This process may be sexual or asexual, but in either case, it results in the continuation of the species. Discuss the differences and similarities you observe among the different types of asexual reproduction.

## 4.3 Types of asexual reproduction

**Objectives**

At the end of this section, the student will be able to:

- *describe the process of asexual reproduction in bacteria, protists, fungi, animals and plants*
- *explain the mechanism of fission*
- *discuss the mechanism of fragmentation*
- *describe the mechanism of budding*
- *investigate the mechanism of vegetative propagation*
- *describe the mechanism of parthenogenesis*

### 4.3.1 Fission

*What are the steps of fission?*

In fission, the organism divides into two (binary fission) or more (multiple fission) equal parts. Binary fission is common among bacteria, algae and protozoa. In binary fission, the body of the unicellular parent divides by mitosis into two approximately equal parts, each of which grows into an individual similar to the parent. In bacteria, the cell simply divides into two and each new cell becomes an independent organism (Fig.4.2). However, before a bacterium divides, the bacterial nucleus is replicated (copied) to produce two identical copies so that the daughter cells receive one copy each. Alternatively, the nucleus of the orgasms divide repeatedly and each daughter nucleus breaks away together with a small portion of the cytoplasm, resulting in the production of many daughter cells. This is common among some parasitic protozoa, for example, malarial parasites. Also, some invertebrates reproduce through fission.

**Did You Know?**

The cells of some species, such as bacteria, can divide every 20-30 minutes. When placed on a solid growth medium in a petri dish, a bacterial cell and its daughter cells undergo repeated cellular divisions and form a group of genetically identical cells called a bacterial colony. Such rapid rate of bacterial cell reproduction is one reason why a small number of bacteria can seriously contaminate our food products.

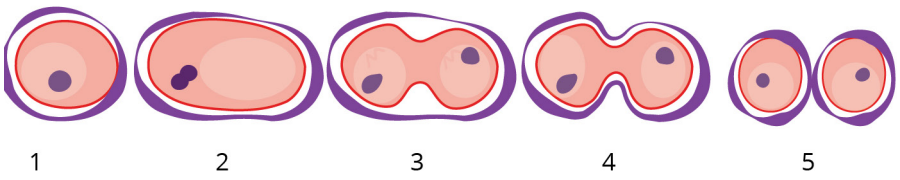


Figure 4.2. Binary fission in bacteria

### 4.3.2 Fragmentation

*What is fragmentation?*

Fragmentation is one of the most common modes of asexual reproduction involving the breakdown of a parent organism into parts that develop into whole organism. Fragmentation is observed in fungi, plants, animals and algae. For Example, Spirogyra, the filamentous green-algae undergoes fragmentation which results in many filaments. Each filament grows into matured filament (Fig.4.3).

Also a multicellular animal (e.g.,worms) breaks into two or more parts, with each fragment capable of becoming a complete individual. Many invertebrates can reproduce asexually by simply breaking into two parts and then regenerating the missing parts of the fragments.

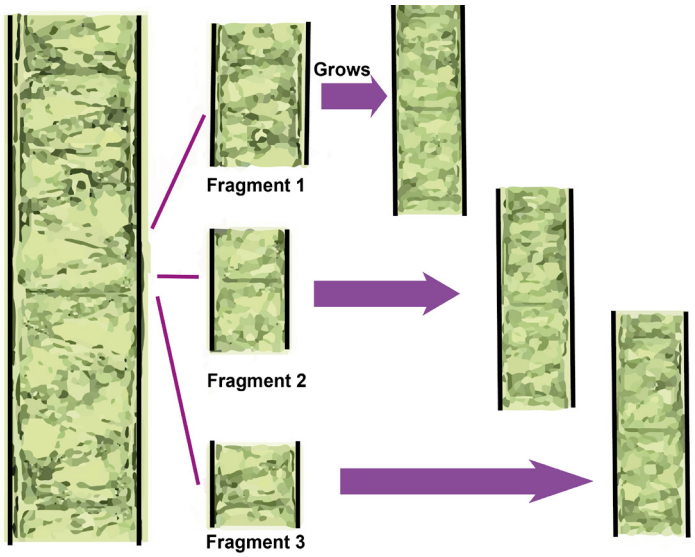


Figure4.3. Fragmentation in filamentous green-algae

### 4.3.3 Budding

*In budding, the two daughter cells are unequal. Why?*

Another common type of asexual reproduction is budding. In this mode of reproduction, the organism divides into two unequal parts. It is common in fugal species and invertebrates. During the process, a bulge forms on the side of the cell, the nucleus divides mitotically, and the bud ultimately detaches itself from the mother cell. For example, in some fungi such as yeasts, a bud develops on the surface of either the yeast cell or the hypha, with the cytoplasm of the bud being continuous with that of the parent cell. The nucleus of the parent cell then divides; one of the daughter nuclei migrates into the bud, and the other remains in the parent cell(Fig.4.4.). Budding also occurs commonly in some invertebrate animals.

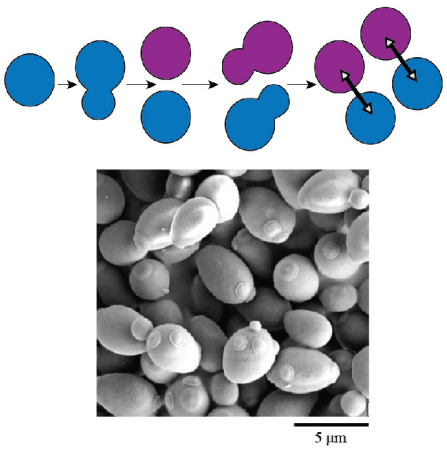


Figure 4.4. Budding in yeast

**Activity 4.3: Experiment on budding and fragmentation**

Make a field visit in your village and collect specimens of organisms that reproduce with budding. Do experimentation on budding and fragmentation. Material required 10% glucose solution , yeast, microscope, slide, cover slip, dropper and test tube

*Why sporulation is an ideal means of asexual reproduction in colonizing the different habitat?*

The majority of fungi, however, reproduce asexually by the formation of spores (i.e., sporulation). Spores are dispersed often by air currents and if they reach a suitable situation, they grow new hyphae. The hyphae develop into a mycelium (Fig. 4.5; left). At the tip of the hyphae, a swelling or sporangium – spore case forms. Penicillium and Mucor are examples of mould fungi that grow on decaying food or vegetable matter (Fig. 4.5; right).

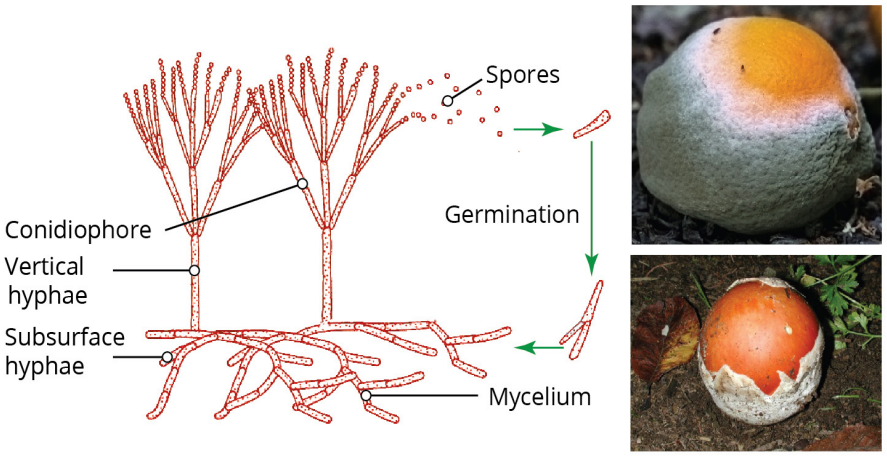


Figure4.5. Asexual reproductions in fungi

## 4.3.4 Vegetative propagation

Vegetative propagation is a method of asexual reproduction in plants where structures with lateral meristems such as roots, stems, buds, and leaves give rise to new self-supporting individual. The following are types of vegetative reproduction.

**Stolons(runners)**

*What is a stolon?*

Runners originate from auxiliary bud in a lower portion of plant and grow along the surface of the soil. In the cultivated strawberry, for example, leaves, flowers, and roots are produced at every other node on the runner. Just beyond each second node, the tip of the runner turns up and becomes thickened. This thickened portion produces first adventitious roots and then a new shoot that continues the runner. Thus a complete plant may develop and take root at the node, nourished for a time by food sent from the parent plant through the stolon. Eventually, the stolon dries up and withers, leaving an independent daughter plant growing a short distance away from the parent.

**Key Terms**

**Chromosome**: the hereditary material that carry the biological information

**Hypha** (pl. hyphae): the long filamentous branches found in fungi

**Mitosis**: type of cell division that produce two identical daughter cells

**Mycelium**: the vegetative part of a fungus, consisting of a network of fine white filaments (hyphae)

**Spore**: reproductive cell

### Rhizome

*What is a rhizome?*

In many plants, horizontal shoots arise from lateral buds near the stem base and grow under the ground. Such underground horizontal stems are called rhizomes. At the nodes of the rhizome are buds, which may develop to produce shoots above the ground. The shoots become independent plants when the connecting rhizome dies. Many grasses propagate by rhizomes; the couch grass (Fig. 4.6) is a good example.

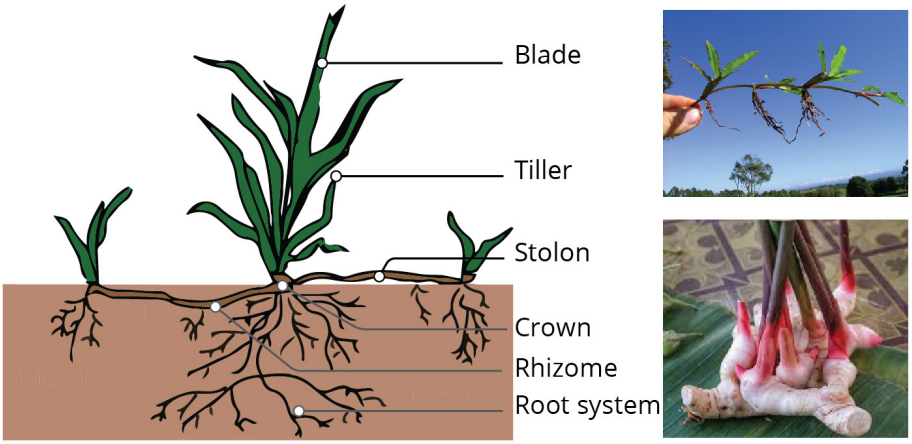


Figure 4.6. Reproduction using stolon and rhizomes

**Activity 4.4: Experimentation on growing potato plants from tuber.**

Make a field visit to your village and collect specimens of potato plants. Materials required include potato tubers, potato, razor blade, iodine solution, microscope, slide, cover slip, and large pot. Take a note on the morphological features and grow potato plants from tubers.

### Corms

*What is a corm?*

Corms are similar to rhizomes, except they are more rounded and fleshy (such as in gladiolus). Corms contain stored food that enables some plants to survive the winter.

### Tubers

*What is a tuber?*

Tubers are modified stems that may store starch, as seen in the potato (Solanum sp.). Tubers arise as swollen ends of stolons, and contain many adventitious or unusual buds. If the tubers are left in the ground or transplanted, the buds will produce shoots, using food stored in the tuber (Fig. 4.7.).

### Bulb

*What is a bulb?*

A bulb, which functions as an underground storage unit, is a modification of a stem that has the appearance of enlarged fleshy leaves emerging from the stem or surrounding the base of the stem.

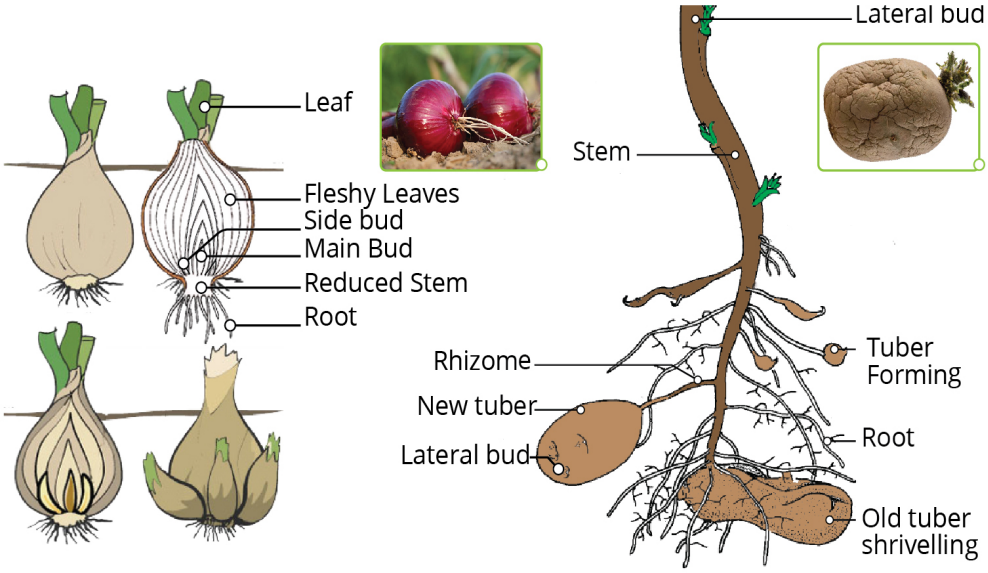


Figure 4.7. Asexual reproduction with tuber and bulb

**Activity 4.5: Experimentation on growing onion plants from bulbs.**

Make a field visit in your village and collect specimens of onion plants. Material required bulb and pot containing soil mixed with compost. Take a note on the morphological features and grow onion plants from bulbs.

### 4.3.5 Parthenogenesis

Some species of animals (e.g., bees) are able to reproduce asexually. Among common honeybees (*Apis mellifera*), a queen bee might lay 2,000 eggs per day. Nearly all of these eggs are fertilized by sperm the queen has received during one of her nuptial fights, and each one of these eggs will develop into one of the worker bees of the colony every one of them a female. A queen can, however, choose to let some of her eggs go unfertilized; no sperm from a male ever fuses with these eggs, yet bees develop within them and hatch from them. Since egg and sperm do not come together in this process, this is not sexual reproduction. Instead, each of these bees has been derived through parthenogenesis: a form of asexual reproduction in which an unfertilized egg develops into an adult organism. Among the honeybees, all the bees derived through parthenogenesis are males these are the few drones of a bee colony.

**Did You Know?**

Whip tail lizard (*Aspidoscelis uniparens)* produces females by employing parthenogenesis. All the members of this species are female, and all reproduction in the species comes through parthenogenesis. Thus, each new lizard develops solely from one of her mother's eggs, meaning that each is a clone of her mother.

**Self Assessment**

1. Discuss the mechanisms of multiple fission.
2. When a food is left open for two or three days, one observes a fruiting body on the food. The taste of food changes? Why?

## 4.4 Sexual reproduction in Humans

**Objectives**

At the end of this section, the student will be able to:

- *describe the mechanism of sexual reproduction*
- *compare and contrast asexual and sexual reproduction*

*What is sexual reproduction?*

Sexual reproduction involves the production of sex cells. It almost always involves two parent organisms. These sex cells are called gametes and they are made in reproductive organs. The gametes are produced through meiosis. Sexual reproduction starts with the union of sperm and an egg in a process called fertilization. This can occur either inside (internal fertilization) or outside (external fertilization) the body of the female. Fertilization results in the formation of a single cell called a zygote. The zygote then grows into a new individual. The female gametes are always larger than the male gametes and are not mobile.

**Self Assessment**

1. What are the advantages of asexual reproduction as compared to sexual reproduction?

**Activity 4.6. cooperative learning**

Read books and write advantages and disadvantages of sexual reproduction.

**Key Terms**

**Egg**: female gamete

**Fuse:** union(fertilization) of egg and sperm

**Gametes**: reproductive cell (sex cells - egg or sperm)

Meiosis: type of cell division whereby gametes are produced

**Sperm**: male gamete

**Zygote**: fertilized egg

## 4.5 Primary and secondary sexual characteristics

**Objectives**

At the end of this section, the student will be able to:

- *differentiate between the primary and secondary sexual characteristics of males and females in humans*
- *describe the biological, psychological, and social changes during the stage of puberty*

*What are primary sexual characteristics?*

The human males are born with the penis, scrotum and testicle whereas females are born with vagina, uterus, and ovaries. These are the primary sexual characteristics in males and females, respectively. At puberty or adolescence these characteristics change markedly.

*What are secondary sexual characteristics?*

Puberty begins in the early teen years. Puberty or adolescence is the time when secondary sex characteristics begin to develop. Secondary sexual characteristics begin to develop so that sexual

**Activity 4.7. Inquiring and researching**

During puberty, humans mature physically and become able to reproduce. What are the major biological, psychological and sociological changes occur during puberty. At what ages do you think males and females go through puberty?

maturity is reached. Sexual maturity means that the potential for sexual reproduction exists. Secondary sexual characteristics in males include:

- growth and maintenance of the male sex organs,
- an increase in body hair, an increase in muscle mass,
- increased growth of the long bones of the arms and legs, and
- deepening of the voice.

*What role do hormones play in puberty?*

The glands of the endocrine system release hormones which control the development and activity of the male reproductive system. The changes that occur during puberty are controlled by sex hormones. These hormones are secreted by the endocrine system. The onset of puberty in males causes the hypothalamus to produce several kinds of hormones. These hormones interact with the pituitary gland.

**Key Terms**

**Puberty**: the time when secondary sex characteristics begin to develop; as secondary sexual characteristics begin to develop, so does sexual maturity, the potential for sexual reproduction.
**Secondary sex characters**: characteristics that are not primarily involved in formation and delivery of egg/sperm, but that are essential for behavioral and functional success of reproduction.

**Did You Know?**

The hypothalamus secretes a hormone that causes the pituitary gland to release two other hormones. The hormones are follicle-stimulating hormone (FSH) and luteinizing hormone (LH). When FSH and LH are released into the bloodstream, are carried to the testes. In the testes, FSH causes the production of sperm cells. LH causes the endocrine cells that are in the testes to produce the male hormone testosterone. Testosterone influences the production of sperm cells. Testosterone is responsible for the growth and development of secondary sex characteristics in the male. The FSH and LH are also secreted in females and influence the development of secondary sex characteristics.

Puberty in females begins in the early teen years. In females, LH causes eggs to be released into the oviduct whereas FSH stimulates the development of follicles in the ovary. A follicle is a group of epithelial cells. These epithelial cells surround a developing egg cell. FSH also causes a hormone called estrogen to be released from the ovary. It is responsible for the secondary sex characteristics of females. Secondary sexual characteristics in females include:

- Increase in growth rates of the long bones of the arms and legs.
- Develop more hair, especially under the arms and in the pubic area.
- The hips broaden, and more fat is deposited in the breasts, buttocks, and thighs.
- The menstrual cycle begins.

*What are the psychological and social changes during puberty? How do they affect life of the youth?*

Young people must adjust to remarkable physiological, anatomical, and psychological transformations during the process of puberty. Their bodies change rapidly, and thus their body image also changes. Any deviations of their bodies from what they or their peers consider "normal" can lead to low self-esteem. For example, females will worry about the size of their breasts and other aspects of their figures and will not feel feminine if these are not in line with the norm of their peers. Similarly, a male may worry about the size of his penis or his physique; and if these are not within the norm, he will feel that something is wrong with him. Young people should realize that there is considerable variation in the timing of the stages of puberty among different individuals, and that most people develop into "normal" adults in the course of their sexual and physical maturation.

An individual who reaches puberty later or earlier than his or her peers can suffer psychological pain. If not handled in a constructive fashion, early or late puberty can lead to poor self-esteem and problems in sexual and other areas of life. For example, late-developing males may suffer from a poor self-image, and this can influence them in later life. They tend to have a lower occupational attainment, get paid less, marry later, and have fewer children than other men of the same adult height. Early maturing males, on the other hand, can have an easier time of it. They tend to be held in higher esteem by their peers because of their broad shoulders and masculine physiques. Early-maturing females suffer more than early-maturing males. Because of their mature bodies (large breasts), their peers make the assumption that they are sexually experienced and sexually "easy," whereas in actuality, early maturing females tend to be submissive, socially indifferent, and low in popularity. Therefore, such individual should get medical or psychological advice to cope up with problems related early or late puberty.

Adolescence is the period between puberty and adulthood, when a good deal of social learning takes place. The length of this period of youth is socially determined. Its length could be influenced by nature, culture, and civilization. Biologically, teenagers are adult after they have reached puberty, when they are capable of having children. Economically, they are adult when they can support themselves and possibly a family. Morally, they are adult when they are responsible for their actions, can express love in a mature manner, and can have productive and meaningful relationships. During adolescence, teenagers must achieve economic and moral adulthood; deal with separation from family.

**Self Assessment**

1. What are the two hormones involved in male puberty released by the pituitary gland?
2. What are the secondary sex characteristics in females?

## 4. 6 Male reproductive structures

**Activity 4.8. Reflective discussion**

The main function of the organs, glands and hormones of the male reproductive system is to produce sperm and deliver them to the female. Discuss the roles of the various parts of the male reproductive system. Draw and label parts of the male reproductive organ along with their function.

**Objectives**

At the end of this section, the student will be able to:

- *Identify the structure and functions of the male reproductive organs.*

*What are the functions of the male reproductive organs?*

The male reproductive system of vertebrates, such as that of human males includes testes, epididymis, vas deferens, accessory glands, and a penis. Paired testes are the sites of sperm production. Each testis is composed of numerous seminiferous tubules, in which the sperm develop. The sperm are surrounded by cells, which nourish the developing sperm. Between the tubules are cells which produce the male sex hormone (testosterone). In most mammals, the two testes are housed permanently in a sac-like scrotum suspended outside the abdominal cavity. This odd arrangement provides an environment of slightly lower temperature, since in most mammals (including humans) viable sperm do not form at temperatures maintained within the body.

The sperm travels from the seminiferous tubules to epididymis, where sperm maturation occurs and then to a vas deferens, the ejaculatory duct. The vas deferens joins the urethra, a duct that carries both sperm and urinary products through the penis. Three sets of accessory glands open in to the reproductive channels: a pair of seminal vesicles, a single prostate gland, and the pair of bulbourethral glands (Fig.4.8). Fluid secreted by these glands furnishes food to the sperm, lubricates the female reproductive tract for sperm, and counteracts the acidity of the vagina so that the sperm retain their viability longer after being deposited in the female. Semen is a mix of sperm, proteins, nutrients, ions, and signalling molecules. Sperm constitute less than 5 percent of semen volume.

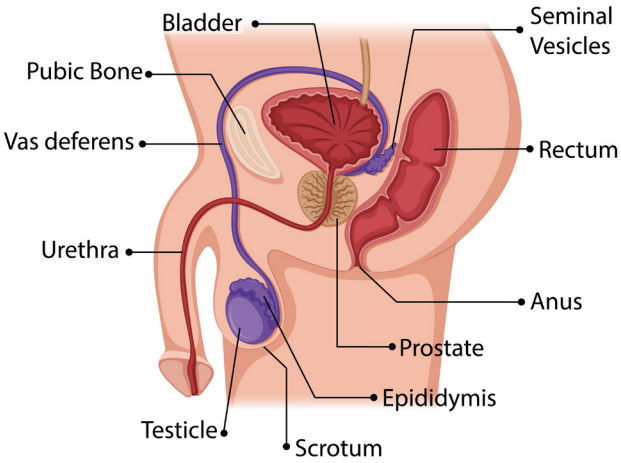


Figure 4.8 Parts of male reproductive systems

The sperm has a "head" that is packed full of genetic material and covered by an enzyme. The enzymes help the sperm penetrate an egg. At its other end, the sperm has a flagellum that it uses to swim toward an egg. In the midsection contains many mitochondria that supply the energy required for flagellar movement (Fig.4.9).

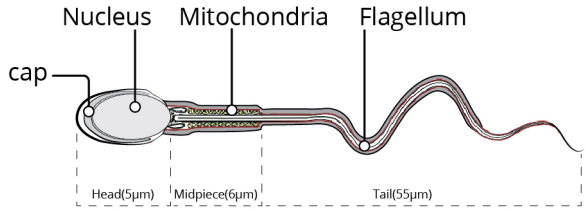


Figure 4.9 Parts of a sperm cell

## Key Terms

**Bulbourethral glands:** secrete a lubricating mucus into the urethra which helps clear the urethra of residual urine.

**Epididymides:** a pair of ducts in which sperm formed in testes mature; each empties into a vas deferens.

**Penis**: male organ of intercourse.

**Prostate gland:** produces alkaline secretions that help raise the pH of the female reproductive tract, making this passage more hospitable to sperm.

**Scrotum**: pouch of skin that encloses a human male's testes.

Semen: sperm mixed with secretions from seminal vesicles and the prostate gland.

**Seminal vesicles:** are exocrine glands which secrete fructose-rich fluid into the vasa deferentia.

**Seminiferous tubules:** inside a testis, coiled tubules that contain male germ cells and produce sperm.

**Testosterone:** main hormone produced by testes; required for sperm production and development of male secondary sexual traits.

**Vas deferens:** one of a pair of long ducts that convey mature sperm toward the body surface.

## Self Assessment

1. What is the advantage of testes located in the scrotum?
2. What does the mid piece of the sperm contain?
3. What are the function of seminal vesicle and protest gland?
4. What is the purpose of the vas deferens?
5. Which glands secrete alkaline fluids?

## 4.7. Female reproductive structures

**Activity 4.9. Investigating**

Discuss the roles of the different parts of the female reproductive systems. Draw and label the various parts along with their function.

**Objectives**

At the end of this section, the student will be able to:

- *Identify female reproductive structures and their functions.*

*What are the functions of female reproductive organs?*

A human female's gonads—her ovaries—lie deep inside her pelvic cavity. They produce and release egg. They also secrete estrogens and progesterone, the main sex hormones in females. Estrogens trigger development of female secondary sexual characteristics and maintain the lining of there productive tract. Progesterone thickens the lining of the reproductive tract in preparation for pregnancy.

Adjacent to each ovary is an oviduct, a hollow tube that connects the ovary to the uterus. Both oviducts open onto the uterus, a hollow, pear shaped organ. The uterine lining consists of glandular epithelium, connective tissues, and blood vessels. The bottom of the uterus, a narrowed region called the cervix, opens into the vagina. The vagina, which extends from the cervix to the body's surface, is the organ of intercourse and the birth canal.

Externally visible organs of the reproductive tract are called genitals. Female genitals include two pairs of liplike skin folds that enclose the openings of the vagina and urethra. Adipose tissue fills the thick outer folds, the labia majora. Thin inner folds are the labia minora. The clitoris lies near the anterior junction of the labia minora. It contains erectile tissue and is highly sensitive to tactile stimulation. The opening into the vagina is often reduced in size in the virgin state by a membrane, the hymen, although in today's more physically active females, this membrane may be much reduced in extent (Fig.4.10).

The paired ovaries of the human female, contain many thousands of eggs. During a woman's fertile years, except following fertilization, approximately 13 eggs mature each year, and usually the ovaries alternate in releasing eggs. Because a woman is fertile for only about 30 years, of the approximately 400,000 eggs in her ovaries at birth, only 300 to 400 have a chance to reach maturity; the others degenerate.

The uterine tubes or oviducts are lined with cilia for propelling the egg away from the ovary from which it was released. The two ducts open into the upper corners of the uterus, or womb, which is specialized for housing the embryo during its intrauterine existence. It consists of thick muscular walls, many blood vessels, and a specialized lining: the endometrium. The uterus is designed to hold more than one developing embryo.

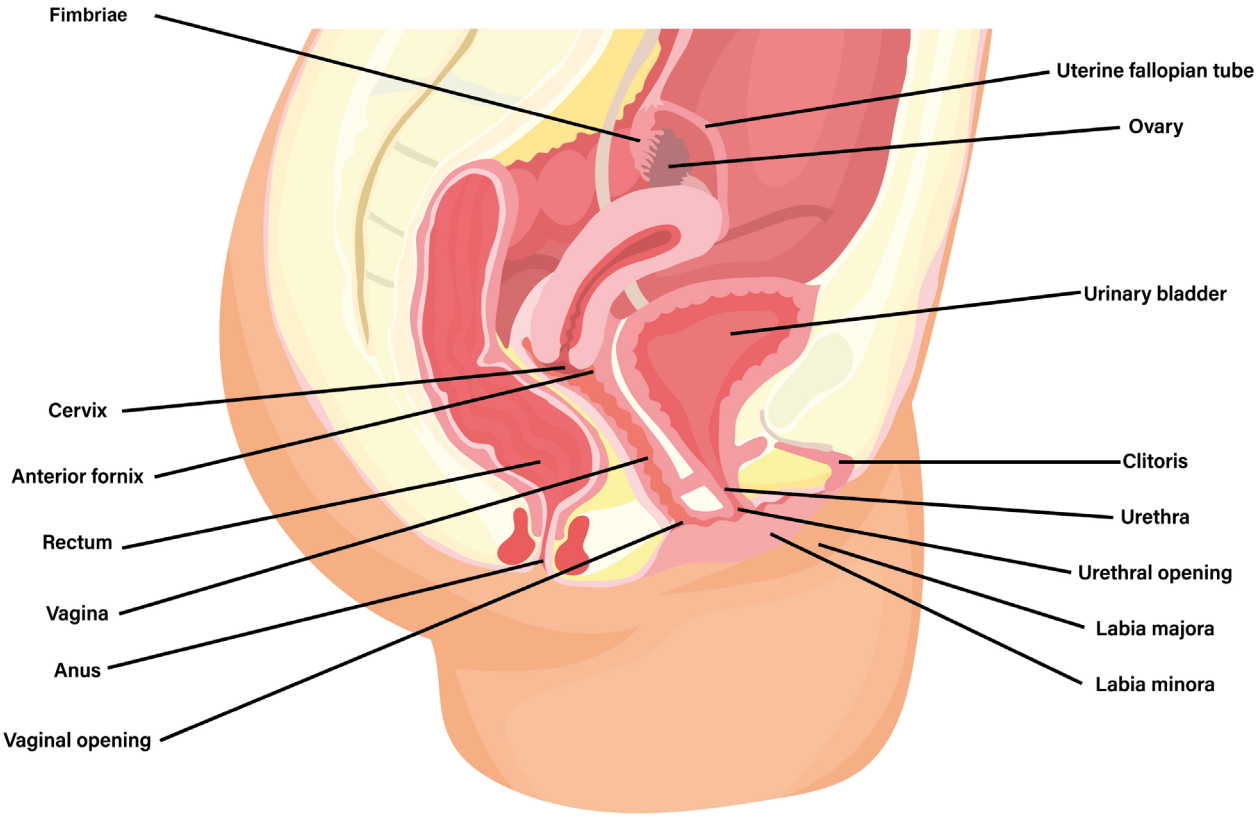


Figure 4.10 Female reproductive systems

## Ovulation

*What is ovulation?*

In humans, egg production occurs before birth. A girl is born with about 2 million eggs. At puberty hormonal changes prompt eggs to mature, one at a time, in an approximately twenty eight- day ovarian cycle. As the cycle begins, the follicle enlarges and a fluid filled cavity forms around it. About two weeks after the follicle began to mature, its wall ruptures and ovulation occurs. The egg and surrounding follicle cells are ejected into the adjacent oviduct. After ovulation, cells of the ruptured follicle develop into a hormone-secreting corpus luteum. If pregnancy does not occur, the corpus luteum breaks down, and a new follicle will begin to mature (Fig.4.11).

**Self Assessment**

1. How are eggs produced?
2. How are eggs released?

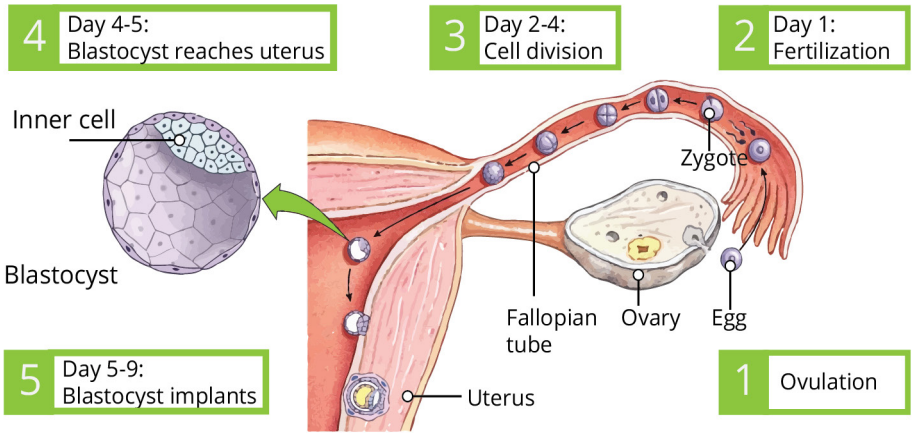


Figure 4.11 Ovulation

## 4.8 The Menstrual cycle

**Activity 4.10: Concept mapping**

Discuss the major changes during the menstrual cycle.

**Objectives**

At the end of this section, the student will be able to:

- *Outline the phases of the menstrual cycle*

*What cyclic changes occur in the ovary and uterus?*

The ovarian cycle described in the previous section is coordinated with cyclic changes in the uterus. We refer to the approximately monthly changes in the uterus as the menstrual cycle. The first day of the menstrual cycle is marked by onset of menstruation, which is the flow of bits of uterine lining and some blood from the uterus, through the cervix, and out of the vagina.

FSH stimulates maturation of an ovarian follicle. The interval of follicle maturation before ovulation is the follicular phase of the cycle. During this time, cells around the egg secrete estrogens that stimulate the endometrium to thicken. The rise in estrogens encourages the pituitary to release more LH. The flow of LH causes the follicle to swell and burst. LH trigger for ovulation. The luteal phase of the cycle begins after ovulation. LH stimulates formation of the corpus luteum, which secretes some estrogens and a lot of progesterone. These hormones cause the uterine lining to thicken and encourage blood vessels to grow through it. The uterus is now ready for pregnancy (Fig.4.12).

**Activity 4.11: Home work**

Make internet search or ask a midwife nurse (Gynecologist) in your village (clinic) about menstrual cycle and the three phases of the cycle, present your results your to classmates.

A woman enters menopause when all the follicles in her ovaries have either been released during menstrual cycles or have disintegrated as a result of aging. With no follicles left to mature, production of estrogen and progesterone is diminished and menstrual cycles cease. Menopause is known only in humans and two species of whales.

**Key Terms**

**Corpus luteum:** a structure that secretes the hormones estrogen and progesterone; progesterone causes changes to occur in the lining of the uterus that prepare it to receive a fertilized egg

**Menstrual cycle:** the series of changes in the female reproductive cycle that occur each month, which include producing an egg and preparing the uterus for receiving the egg

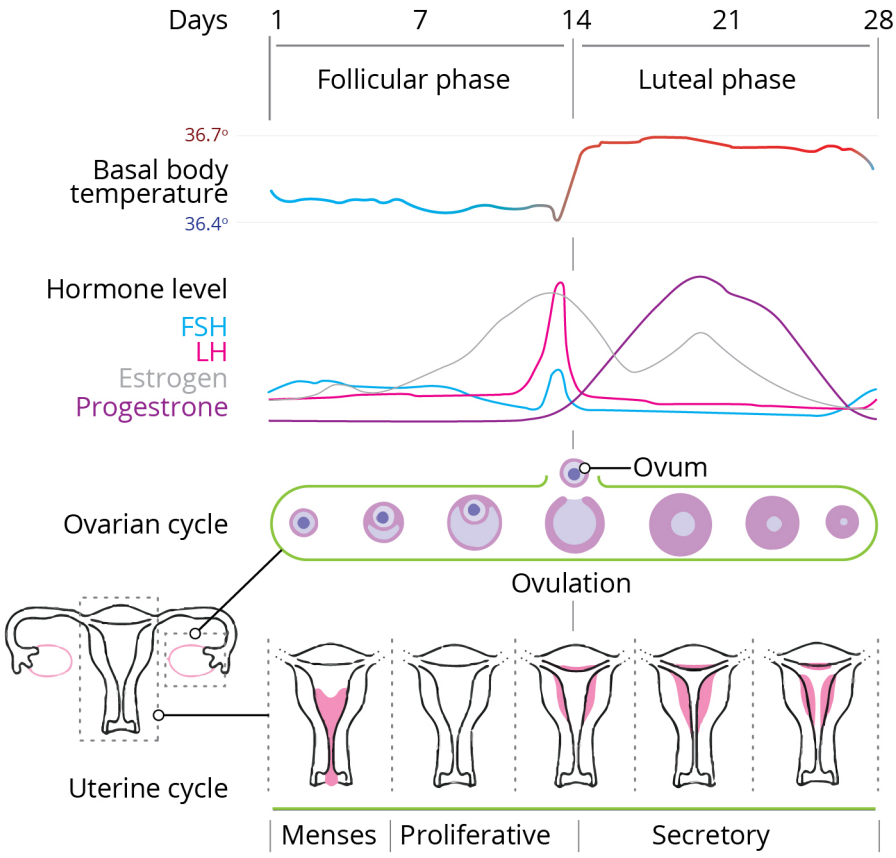


Figure4.12. Menstrual cycle

**Self Assessment**

1. What are the three phases of the menstrual cycle?
2. What is shed during menstrual flow?
3. What two female hormones are secreted by the corpus luteum?

## 4.8 Fertilization and pregnancy

**Objectives**

At the end of this section, the student will be able to:

- *define fertilization and pregnancy*
- *describe process of twin formation and types*

**Activity 4.12 Jigsaw groups**

The union of an egg and a sperm results in a fertilized egg. This single cell must undergo many changes before it develops into a fetus. List the changes that you know occur in the developing embryo and fetus.

### Mating and fertilization

*What is mating?*

Sexual arousal in the male results in an erection. That is, the penis becomes firm and erects as a result of blood flowing into the erectile tissue. Arousal in the female stimulates the lining of the vagina to produce mucus. This lubricates the vagina and makes it easy for the erect penis to enter. In the act of copulation, the male inserts the penis into the female's vagina. The sensory stimulus in the male, which results in the ejaculation of semen into the top of the vagina.

*What is fertilization?*

The sperm swims through the cervix and into the uterus by wriggling movements of their tails. They pass through the uterus and enter the oviduct. If there is an ovum in the oviduct, one of the sperm may bump

into it and stick to its surface. The sperm then enters the cytoplasm of the egg and the male nucleus of the sperm fuses with the female nucleus. This is the moment of fertilization (Fig.4.1). The released egg is thought to survive for about 24 hours; the sperm might be able to fertilize an ovum for about 2 or 3 days. So there is only a short period of about 4 days each month when fertilization might occur. If this fertile period can be estimated accurately, it can be used either to achieve or to avoid fertilization (conception).

### Twins (Multiple births)

Many mammals give birth to more than one offspring at a time, each member of which has come from a separate egg. There are some mammals, however, that have only one offspring at a time, although occasionally they may have more than one.

Human twins may come from one zygote (identical, or monozygotic twins) or two zygotes (non-identical, dizygotic, or fraternal twins). Fraternal twins do not resemble each other any more than other children born separately in the same family, but identical twins are, of course, strikingly alike and always of the same sex. Triplets, quadruplets, and quintuplets may include a pair of identical twins. The other babies in such multiple births usually come from separate zygotes. About 33% of identical twins have separate placentas, but the other identical twins share a common placenta.

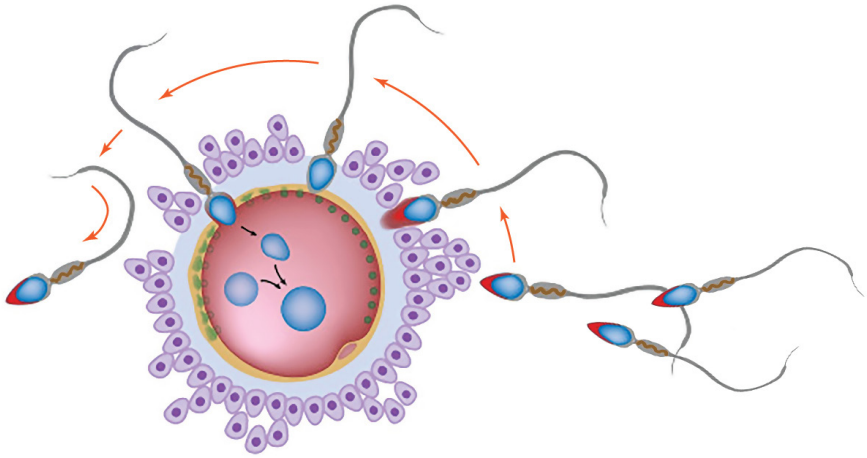

Figure 4.13. Fertilization

### Pregnancy and development

*What is implantation?*

The fertilized egg (zygote) first divides into two cells. Each of these divides again, so producing four cells. The cells continue to divide in this way to produce a solid ball of cells (Fig. 4.15), an early stage in the development of the embryo. This early embryo travels down the oviduct to the uterus. Here it sinks into the lining of the uterus,

a process called implantation. The embryo continues to grow and produces new cells that form tissues and organs. After 8 weeks, when all the organs are formed, the embryo is called a fetus. One of the first organs to form is the heart, which pumps blood around the body of the embryo. Inside the uterus the embryo becomes enclosed in a fluid-filled sac called the amnion or water sac, which protects it from damage and prevents unequal pressures from acting on it. The fluid is called amniotic fluid.

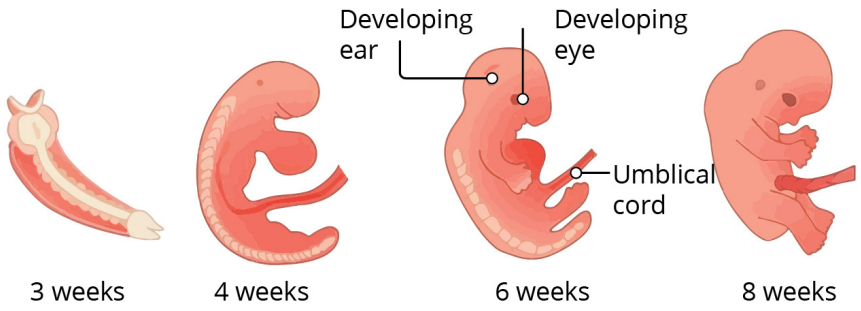


Figure 4.14 Human embryo developmental stages until week eight

The oxygen and food needed to keep the embryo alive and growing are obtained from the mother's blood by means of a structure called the placenta. The placenta becomes closely attached to the lining of the uterus and is attached to the embryo by a tube called the umbilical cord. Oxygen and nutrients such as glucose and amino acids pass across the placenta to the embryo's bloodstream. Carbon dioxide passes from the embryo's blood to that of the mother. Blood entering the placenta from the mother does not mix with the embryo's blood. Figure 4.15 shows the human embryo from 5 to 35 weeks surrounded by the amnion and placenta.

## 4.10 Methods of birth control

**Objectives**

At the end of this section, the student will be able to:

- *discuss the methods of prevention of pregnancy*
- *explain the advantages and disadvantages of different birth control methods.*

**Activity 4.13: Collaborative learning groups**

Contraception, the deliberate prevention of pregnancy, can be achieved in a number of ways. Some contraceptive methods prevent gamete development or release from female or male gonads; others prevent fertilization by keeping sperm and egg apart; and still, others prevent implantation of an embryo. Discuss the mechanisms of action; advantages and disadvantages; degree of effectiveness of different birth control methods.

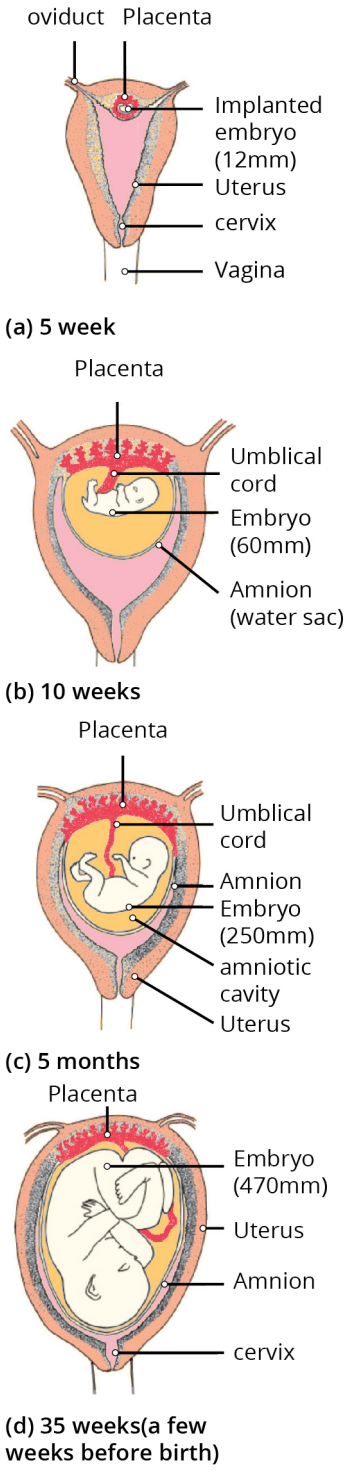


Figure 4.15 Growth and development in the uterus (5 to 35 weeks)

*What can prevent pregnancy?*

As little as 4 weeks after giving birth, it is possible, though unlikely, that a woman may conceive again. Frequent breastfeeding may reduce the chances of conception. Nevertheless, it would be possible to have children at about 1-year intervals. Most people do not want, or cannot afford, to have as many children as this. All human communities, therefore, practice some form of birth control to space out births and limit the size of the family.

**Natural methods of family planning**

- **Abstinence**

This is the most obvious way of preventing a pregnancy. This involves a couple avoiding sexual intercourse. In this way, sperm cannot come into contact with an egg and fertilization cannot happen. It is the effective method with added advantage of preventing exposure to sexually transmissible pathogens.

- **Monitoring body temperature**

If it were possible to know exactly when ovulation occurred, intercourse could be avoided for 3–4 days before and 1 day after ovulation. At the moment, however, there is no simple, reliable way to recognize ovulation, though it is usually 12–16 days before the onset of the next menstrual period. By keeping careful records of the intervals between menstrual periods, it is possible to calculate a potentially fertile period of about 10 days in mid-cycle, when sexual intercourse should be avoided if children are not wanted. On its own, this method is not very reliable but there are some physiological clues that help to make it more accurate. During or soon after ovulation, a woman's temperature rises by about 0.5 °C. It is reasonable to assume that 1 day after the temperature returns to normal, a woman will be infertile. There is 25% chance of pregnancy per year.

- **Cervical mucus**

Another clue comes from the type of mucus secreted by the cervix and lining of the vagina. As the time for ovulation approaches, the mucus becomes more fluid. Women can learn to detect these changes and so calculate their fertile period. By combining the 'calendar', 'temperature' and 'mucus' methods, it is possible to achieve about 80% 'success', i.e. only 20% unplanned pregnancies.

Natural methods have no side effects and this method is permitted by most religions. Carried out with care and scientific precision about recording techniques it can be very effective. Depends on full co-operation of both partners and it is not always easy to pinpoint ovulation so pregnancy can result. There is a chance of 10 pregnancies per 100 women per year.

**Artificial methods of family planning (barrier methods)**

- **Sheath or condom**

A thin rubber sheath is placed on the erect penis before sexual intercourse. The sheath traps the sperm and prevents them from reaching the uterus. It also prevents the transmission of sexually transmitted infections (STIs). There is no side effects do not need medical advice, used every time you have sex offers protection against sexually transmitted diseases such as syphilis and HIV/AIDS. It can interrupt intercourse. Sheath may tear or get damaged during intercourse, allowing semen to get through. There is a chance of 2.5 pregnancies per 100 woman years.

- **Diaphragm**

A thin rubber disc, placed in the vagina before intercourse, covers the cervix and stops sperm entering the uterus. Condoms and diaphragms, used in conjunction with chemicals that immobilize sperm, are about 95% effective. However, a diaphragm does not prevent the risk of transmission of STIs (Fig. 4.16). There are no side effects, offers some protection against cervical cancer. It must be initially fitted by a doctor. May be incorrectly positioned or damaged and allow sperm past. Gives better protection against pregnancy when combined with spermicide. There is a chance of 2.5 pregnancies per 100 woman years.

- **Femidom**

This is a female condom. It is a sheath or pouch, made of polyurethane or rubber, with a flexible ring at each end. The ring at the closed end of the sheath is inserted into the vagina to hold the femidom in place. The ring at the open end is placed outside the vagina. During sexual intercourse, semen is trapped inside the femidom. A femidom reduces the risk of infection by STIs. There is no side effects, don't need medical advice, used every time you have sex it protects from infection with HIV/AIDS or other sexually transmitted diseases. It can only be used once, can be expensive, gives better protection against pregnancy when used with spermicide, and takes practice to insert it properly.

- **Spermicides**

Spermicides are chemicals which, though harmless to the tissues, can kill or immobilize sperm. The spermicide, in the form of a cream, gel or foam, is placed in the vagina. On their own, spermicides are not very reliable but, in conjunction with condoms or diaphragms, they are effective.

- **Intra-uterine device (IUD)**

A small T-shaped plastic and copper device, also known as a coil, can be inserted by a doctor or nurse into the wall of the uterus, where it probably prevents implantation of a fertilized ovum. It is about 98% effective but there is a small risk of developing uterine infections, and

**Activity 4.14: Survey/ Interviewing/ role play**

Make Internet search or ask a midwife nurse (Gynecologist) in your village (school clinic) about artificial methods of family planning methods. Alternatively, you could assign one of your classmate to act as midwife nurse (Gynecologist) and ask her/ him about mechanisms of action; advantages and disadvantages; degree of effectiveness of different birth control methods.

it does not protect against STIs. Once inserted, no further steps need to be taken. It is relatively effective at preventing implantation and pregnancy. It can cause pain and heavy periods; can cause uterine infections which may lead to infertility. If pregnancy does occur, it has a high chance of being in the Fallopian tubes (ectopic pregnancy). There is a chance 2.5 pregnancy per 100 woman years

- **Intra-uterine system (IUS)**

This is similar to an IUD; is T-shaped and releases the hormone progesterone slowly over a long period of time (up to 5 years). The hormone prevents ovulation. An IUS does not protect against STIs.

- **Contraceptive pill**

The pill contains chemicals, which have the same effect on the body as the hormones oestrogen and progesterone. When mixed in suitable proportions these hormones suppress ovulation and so prevent conception. The pills need to be taken each day for the 21 days between menstrual periods.

There are many varieties of contraceptive pill in which the relative proportions of oestrogen- and progesterone-like chemicals vary. They are 99% effective, but long-term use of some types may increase the risk of cancer of the breast and cervix. The pill does not protect against STIs.

- **Contraceptive implant**

This is a small plastic tube of about 4 cm long which is inserted under the skin of the upper arm of a woman by a doctor or nurse. Once in place, it slowly releases the hormone progesterone, preventing pregnancy. It lasts for about 3 years. It does not protect against STIs, but has more than a 99% success rate in preventing pregnancy.

- **Contraceptive injection**

This injection, given to women, contains progesterone and stays effective for between 8 and 12 weeks. It works by thickening the mucus in the cervix, stopping sperm reaching an egg. It also thins the lining of the uterus, making it unsuitable for implantation of an embryo. It does not protect against STIs.

**Surgical methods**

- **Male sterilization – vasectomy**

This is a simple and safe surgical operation in which the man's sperm ducts are cut and the ends sealed. This means that his semen contains the secretions of the prostate gland and seminal vesicle but no sperm so cannot fertilize an ovum. Sexual desire, erection, copulation and ejaculation are quite unaffected. The testis continues to produce sperm and testosterone. The sperm are removed by white cells as fast as they

form. The testosterone ensures that there is no loss of masculinity. The sperm ducts can be rejoined by surgery but this is not always successful.

- **Female sterilization– laparotomy**

A woman may be sterilized by an operation in which her oviducts are tied, blocked or cut. The ovaries are unaffected. Sexual desire and menstruation continue as before, but sperm can no longer reach the ova. Ova are released, but break down in the upper part of the oviduct. The operation cannot usually be reversed. Both vasectomy and laparotomy are almost 100% guaranteed to prevent pregnancy and permanent control of fertility. Remove the problem of human error in contraception. For women in particular it involves a general an aesthetic. Not easily reversible. There a chance of 0.05 pregnancies per 100 woman years.

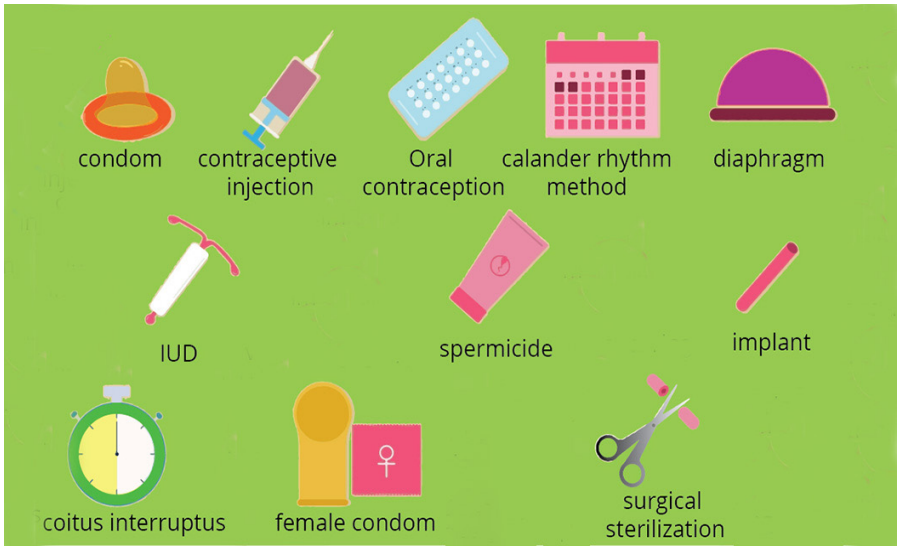


Figure 4.16 The different Contraceptive methods used by females and males

Sterilization is the permanent prevention of gamete production or release. For women, the most common method is tubal ligation, the sealing shut or tying off (ligating) of a section of each oviduct to prevent eggs from traveling into the uterus. Similarly, vasectomy in men is the cutting and tying off of each vas deferens to prevent sperm from entering the urethra. Sex hormone secretion and sexual function are unaffected by both procedures, with no change in menstrual cycles in females or ejaculate volume in males. Although tubal ligation and vasectomy are considered permanent, both procedures can in many cases be reversed by microsurgery.

**Self Assessment**

1. What are the disadvantages of diaphragm?
2. What are the disadvantages of vasectomy and laparotomy?
3. Why is abstinence important for the youth like you?

## 4.11 Sexually transmitted infections (STIs): Transmission and prevention

**Objectives**

At the end of this section, the student will be able to:

- *describe the types, modes of transmission and preventive mechanisms of sexually transmitted infection*

*What are causes and effects of common sexually transmitted infections,and how are they treated?*

Sexually transmitted infections are infections which spread through sexual contact. trichomoniasis, syphilis, gonorrhea, chaceriod and HIV/AIDS are the common STIs in Ethiopia.

**Trichomoniasis**

It is caused by the flagellated protozoan Trichomonas vaginalis. Many infected people do not have symptoms, but some infected women have a yellowish discharge, and a sore, itchy vagina. In both sexes, an untreated infection can cause infertility. Some epidemiological studies suggest that, in men, untreated trichomoniasis may increase the risk of benign prostate enlargement and aggressive prostate cancer. A single dose of an antiprotozoal drug can quickly cure the infection. Both partners should be treated.

**Chlamydia**

It is caused by Chlamydia trachomatis. Chlamydias are small bacteria. In women, an infection of the reproductive tract by bacteria most often goes undetected. Some women and most men experience painful urination; most infected men have a clear or yellow discharge from the penis. Left untreated, a Chlamydia infection can scar the reproductive tract and lead to infertility in both sexes. An infection can be passed from a mother to child during birth, causing pneumonia and conjunctivitis in the newborn. Chlamydia can be cured with antibiotics.

**Gonorrhea**

Is the second most common bacterial STI is caused by Neisseria gonorrhoeae. Men usually develop symptoms within one week of becoming infected; yellow pus oozes from the penis and urination becomes frequent and painful. By contrast, most women have no early symptoms. In both sexes an infection can damage reproductive ducts and cause sterility. Gonorrhea is treated with antibiotics, but

strains resistant to the most widely used antibiotics are increasingly common. Gonorrhea could harms the joints and skin, but can also affect the heart and liver.

**Syphilis**

Is caused by Treponema pallidum, a spiral shaped bacterium. During sex with an infected partner, these bacteria get onto the genitals or into the cervix, vagina, or oral cavity. They slip into the body through tiny cuts. If untreated, the infection can become systemic. Skin chancres appear and the liver, bones, and eventually the brain can be damaged. Like gonorrhea, syphilis is treated with antibiotics.

**HIV/AIDS**

The disease is now known as Human Immunodeficiency Virus, or HIV. HIV kills immune cells in the body. HIV leads to Acquired Immune Deficiency Syndrome, or AIDS. Once attached, the virus can penetrate the immune cell. The virus may remain inactive for months.

**Spread of HIV**

The disease HIV is spread from an infected person through blood or body fluids. This can occur through direct contact with the infected blood or body fluids. It also can occur through contact with objects that have been contaminated by infected blood or body fluids. Intimate sexual contact and use of contaminated intravenous needles are known methods of disease transmission. HIV also can be transmitted by blood transfusion if the blood is contaminated. A pregnant woman who has HIV can transmit it to her fetus. The virus also can be transmitted through breast milk.

*What are the symptoms of AIDS?*

The first symptoms of AIDS may not appear for as many as ten years after a person is infected. During this time, the AIDS virus reproduces, infecting more and more immune cells. People infected with HIV may develop AIDS. Early symptoms of AIDS may include swollen lymph nodes, loss of appetite, weight loss, fever, rashes, night sweats, and fatigue. It is not known how many people who are infected with HIV will develop AIDS. AIDS weakens the body's immune system and the body cannot fight off other infectious diseases or certain forms of cancer.

**Prevention and control of HIV**

Abstinence from intimate sexual contact protects against HIV and other sexually transmitted diseases. HIV transmission can be prevented among users of illegal drugs if they do not share needles. When AIDS first appeared, there were no effective drugs. Today, there

**Activity 4.15: Inquiry and research projects**

Read books or search in Internet or ask a clinical nurse in your village (school clinic) about the most common sexually transmitted infectious in Ethiopia (e.g., HIV/AIDS, syphilis, gonorrhea, trichomoniasis and chancroid). Discuss causes, the modes transmission and methods of preventions.

is a range of drugs that can be given separately or as a 'cocktail', which slow the progress of the disease. Research to find a vaccine and more effective drugs is ongoing. There is a range of blood tests designed to detect HIV infection. These tests do not detect the virus but do indicate whether antibodies to the virus are in the blood. If HIV antibodies are present, the person is said to be HIV positive. The tests vary in their reliability and some are too expensive for widespread use.

- **Control of the spread of STIs**

The best way to avoid sexually transmitted infections is to avoid having sexual intercourse with an infected person. However, the symptoms of the disease are often not obvious and it is difficult to recognize an infected individual. So the STI is avoided by not having sexual intercourse with a person who might have the infection. Such persons are:

- prostitutes who offer sexual intercourse for money
- people who are known to have had sexual relationships with many others
- Casual acquaintances whose background and past sexual activities are not known.

These are good reasons, among many others, for being faithful to one partner. The risk of catching a sexually transmitted infection can be greatly reduced if the man uses a condom or if a woman uses a female condom. These act as barriers to bacteria or viruses. If a person suspects that he or she has caught a sexually transmitted infection, treatment must be sought at once. Treatment is always confidential. The patients must, however, ensure that anyone they have had sexual contact with also gets treatment. There is no point in one partner being cured if the other is still infected. STIs that are caused by a bacterium, such as syphilis and gonorrhea, can be treated with antibiotics if the symptoms are recognized early enough. However, HIV is viral so antibiotics are not effective.

**Activity 4.16: Peer conferencing**

AIDS: Acquired Immune Deficiency Syndrome. The virus that causes AIDS is the human immunodeficiency virus (HIV). Discuss the transmission mechanisms of HIV; the different control method of the spread of AIDS and responsible sexual behavior and HIV/AIDS

**Self Assessment**

1. What are the common sexually transmitted infections in Ethiopia? How do we control them?

## Unit review

- Reproduction is one of the ubiquitous properties of life. The ability of organisms to reproduce to form their own kind is the one characteristic that best distinguishes living things from nonliving matter.
- Asexual reproduction is the process resulting in the production of genetically identical offspring from one parent. It occurs without gametes or fertilization.
- The basic forms of asexual reproduction are fission (binary and multiple), budding, and fragmentation.
- Many flowering plants reproduce asexually by vegetative propagation. The stolon of the strawberry plant is a horizontal stem that grows above the ground, takes root at the nodes and produces new plants. Rhizomes, corms, bulbs and tap root may store food, which is used to accelerate early growth.
- Sexual reproduction is the process involving the fusion of the nuclei of two gametes to form a zygote and the production of offspring that are different from each other. The male gamete is small and mobile. The female gamete is larger and not often mobile. The female gamete of an animal is an egg.
- Fertilization is the fusion of gamete nuclei. Fertilization happens when a sperm enters an ovum and the sperm and egg nuclei join up (fuse).The fertilized egg (zygote) divides into many cells and becomes embedded in the lining of the uterus. Here it grows into an embryo.
- The human males are born with the penis, scrotum and testicle whereas females are born with vagina, uterus, and ovaries. These are the primary sexual characteristics in males and females, respectively.
- Secondary sexual characteristics in males include: growth and maintenance of the male sex organs, an increase in body hair, an increase in muscle mass, increased growth of the long bones of the arms and legs, and deepening of the voice.
- Secondary sexual characteristics in females include: increase in growth rates of the long bones of the arms and legs, develop more hair, especially under the arms and in the pubic area, the hips broaden, and more fat is deposited in the breasts, buttocks, and thighs, the menstrual cycle begins.
- Young people must adjust to remarkable physiological, anatomical, and psychological transformations during the process of puberty.
- Young people should realize that there is considerable variation in the timing of the stages of puberty among different individuals, and that most people develop into “normal” adults in the course of their sexual and physical maturation.
- Adolescence is the period between puberty and adulthood, when a good deal of social learning takes place.
- Biologically, teenagers are adult after they have reached puberty, when they are capable of having children.
- Economically, they are adult when they can support themselves and possibly a family.
- Morally, they are adult when they are responsible for their actions, can express love in a mature manner, and can have productive and meaningful relationships.

- During adolescence, teenagers must achieve economic and moral adulthood; deal with separation from family,
- Human testes reside within a scrotum. They produce sperm and testosterone. Sperm form continually from germ cells inside the testes' seminiferous tubules. The sperm mature in an epididymis that opens into a vas deferens.
- Secretions from the seminal vesicles and prostate gland join with sperm to form semen. Semen is expelled from the body through the urethra that runs through the penis.
- Human ovaries produce eggs and sex hormones. An oviduct conveys an egg to the uterus. The cervix of the uterus opens into the vagina, which serves as the organ of intercourse and the birth canal.
- Pituitary release follicle stimulating hormone (FSH) and luteinizing hormone (LH).
- FSH causes an ovarian follicle to begin maturing. Follicle cells around an egg, which formed before birth, proliferate and secrete estrogens and progesterone.
- LH triggers ovulation of the egg. After ovulation, the corpus luteum secretes progesterone that primes the uterus for pregnancy. When the corpus luteum breaks down, menstruation occurs.
- The ovarian cycle is coordinated with cyclic changes in the uterus. We refer to the approximately monthly changes in the uterus as the menstrual cycle.
- Spermenters the cytoplasm of the egg and the male nucleus of the sperm fuses with the female nucleus. This is the moment of fertilization.
- Human twins may come from one zygote (identical, or monozygotic twins) or two zygotes (non-identical, dizygotic, or fraternal twins).
- Fraternal twins do not resemble each other any more than other children born separately in the same family, but identical twins are, of course, strikingly alike and always of the same sex.
- Soon after the ball of cells reaches the uterus, some of the cells, instead of forming the organs of the embryo, grow into a disc-like structure, the placenta. The placenta becomes closely attached to the lining of the uterus and is attached to the embryo by a tube called the umbilical cord.
- Sexual intercourse can pass protozoan, bacterial and viral pathogens between partners. The consequences of a STIs range from mild discomfort to sterility and systemic disease.
- Protozoan and bacterial STIs can be cured with antibiotics, but there are no drugs to cure viral STIs.
- There are natural and artificial methods birth control methods. Abstaining from sex is the effective method with added advantage of preventing exposure to sexually transmissible pathogens.
- Artificial methods of family planning barrier methods includes sheath or condom, diaphragm, femidom, spermicides, intra-uterine device (IUD), intra-uterine system (IUS), contraceptive pill, contraceptive implant, contraceptive injection, vasectomy and laparotomy.

## Review Questions

**Part One (Matching Items): Match items under column A with the appropriate item under column B.**

| | A | | B |
|---|---|---|---|
| 1 | FSH and LH | A | Birth canal |
| 2 | Prostate gland | B | Secrete fructose rich fluid |
| 3. | Testis | C | Produces estrogens and Progesterone |
| 4 | Epididymis | D | Thin inner folds |
| 5 | Labia majora | E | Pituitary gland |
| 6 | Endometrium | F | Secretes semen components |
| 7 | Seminal vesicles | G | Conveys sperm out of body |
| 8 | Ovary | H | Produces testosterone |
| 9 | Oviduct | I | Usual site of fertilization |
| 10 | Vagina | J | Lining of uterus |
| 11 | Urethra | K | Fat-padded skin folds |
| 12 | Labia minora | L | Stores sperm |

**Part Two (Multiple Choice Items): Choose the correct answer among the given alternative**

1. Sexual reproduction .....
   A. Requires formation of gametes by meiosis
   B. Produces offspring identical in their traits
   C. Occurs only in vertebrates
   D. All of the above
2. The cervix is the entrance to the .....
   A. Oviducts
   B. Vagina
   C. Uterus
   D. Scrotum
3. Semen contains secretions from the .....
   A. Adrenal gland
   B. Prostate gland
   C. Pituitary gland
   D. Corpus luteum
4. Sperm in an epididymis passes next into the .....
   A. Prostate gland
   B. Urethra
   C. Seminiferous tubules
   D. Vas deferens
5. A male attains an erection when .....
   A. The posterior pituitary releases oxytocin
   B. Spongy tissue inside the penis fills with blood
   C. Muscles running the length of the penis contract
   D. Leydig cells release a surge of testosterone

6. Birth control pills deliver synthetic .
   A. Estrogens and progesterone
   B. Oxytocin and prostaglandins
   C. LH and FSH
   D. Testosterone
7. Which one of the following is not the disadvantage of asexual reproduction
   A. Little variation created
   B. No mate is needed,
   C. No gametes are needed,
   D. All the good characteristics of the parent are passed on to the offspring
8. Morally, teenagers are adult after they have reached puberty, when they are capable of having children.
   A. True B. False

**Part Three: Critical thinking question**

1. State exactly what happens at the moment of fertilization.
2. From the list of changes at puberty in girls, select those that are related to childbearing and say what part you think they play.
3. How do sperm differ from egg in their structure?
4. Is fertilization likely to occur if mating takes place:
   a. 2 days before ovulation
   b. 2 days after ovulation
5. Define, and distinguish among, the terms fission, fragmentation, parthenogenesis, budding and vegetative propagation.
6. Explain the function of the corpus luteum in the menstrual cycle. If fertilization of the ovulated egg happens, what endocrine events occur to support pregnancy?
7. Explain how the female hormones FSH, LH, and estrogen interact during the menstrual cycle to induce ovulation and, subsequently, formation of the corpus luteum.
8. What are the male sex hormones and what are their functions?
9. One of the first signs of pregnancy is that the menstrual periods stop. Explain why you would expect this.
10. What are causes and effects of common STIs, and how are they treated?
11. Describe, and distinguish among, the birth control methods - vasectomy, diaphragm, contraceptive pill, spermicides and laparotomy.
12. Name the general location and give the function of the following reproductive structures: seminiferous tubules, vas deferens, urethra, seminal vesicles, prostate gland, bulbourethral glands, mature follicle, oviducts, uterus, vagina, endometrium.
13. Match each disease with the type of organism that causes it. The choices can be used more than once.

| | | | |
|---|---|---|---|
| i | Chlamydial infection | A. | Bacteria |
| ii | AIDS | B. | Protozoa |
| iii | Syphilis | C. | Virus |
| iv | Gonorrhea | | |
| v | Trichomoniasis | | |