

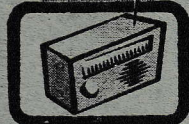
INSTITUTE OF ADULT EDUCATION  
OPEN AND DISTANCE LEARNING



# BIOLOGY

TEWW B<sub>2</sub>

## MODULE 7 Reproduction



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**BIOLOGY**  
**TEWW B<sub>2</sub>**

**MODULE 7**  
**Reproduction**

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## 7.0.1 INTRODUCTION TO THE MODULE/UNIT

Dear learner, you are welcome to module seven.

Living things do not live forever, there comes a time when the organisms die. Even though death cannot be avoided, life has never ended from the face of the earth since it first appeared and it is not likely to disappear. What then makes life continue when organisms are continuously dying? The answer is that organisms have ability to form new ones. The new organisms replace those that die and so life continues on the face of the earth.

In this module you are going to learn about reproduction in organisms particularly humans and plants. We shall discuss types of reproduction and their examples, Meiosis as the type of cell division and reproductive system in human i.e. female and male parts. We shall also see the diseases that affect the reproductive tract and methods used in family planning.

It is my hope that you will enjoy it; welcome.

## 7.0.2 OBJECTIVES OF THE MODULE/UNIT



At the end of this module you should be able to:

- Explain the concept of reproduction.
- Distinguish between sexual and asexual reproduction.
- Explain the merits and demerits of sexual and asexual reproduction.
- State the types of twins and explain their differences.
- Mention types of infections and diseases of reproductive tract.
- Describe family planning.
- Give the meaning of meiosis.
- Explain the significance of meiosis in relation to reproduction
- Explain sexual reproduction in Mammals.
- Identify parts of male and female reproductive organs.
- Describe the process of gamete formation and state its importance in reproduction.
- Explain the human reproductive system.
- Give the meaning and causes of twins.
- State the types of twins and explain their differences.
- Describe the disorders and complication of reproductive system.
- Explain infections and diseases of reproductive tracts.
- Explain the meaning of sexuality, sexual health and responsible behaviors.
- Describe family planning.
- Describe the reproduction process in plants.

### **7.1.1 REPRODUCTION**

In coordination you learnt about nervous system and effects of hormones in living things. You saw that different parts of the body link together in order to properly perform their functions. For example, pituitary gland secretes the hormones that stimulate gonads to produce hormones. For instance, female gonads (ovaries produce a hormone called oestrogen which is responsible for development of female reproductive system and secondary sexual characteristics. All mature healthy living things form new individuals of their own kind to replace those that die. This is what we call reproduction.

#### **The Concept of Reproduction**

Reproduction can be defined as the ability of organisms to form and produce new ones of their own kind.

#### **Importance of reproduction**

The importances of reproduction are that it:

- Helps to transmit materials for inheritance (genetic material) from one generation to the next. Thus, organisms reproduce new ones of their own kind e.g. human gives rise to human only.
- Increases the total number of individuals in populations where conditions are suitable.
- Brings about genetic variation among organisms of the same species e.g. the differences observed in human such as height, skin, and colour, type of hair, nose, ear lobe and tongue rolling.

## **Types of Reproduction**

There are two ways by which organisms can reproduce. These are:

- i. Sexual reproduction.
- ii. Asexual reproduction.

### **Sexual Reproduction**

This is the type of reproduction which involves the union of two gametes. This type of reproduction produces offspring that are genetically different from their parents.

### **Asexual Reproduction**

This is the type of reproduction which involves a single parent and therefore, does not involve gametes. The offspring produced asexually are identical to their parents.

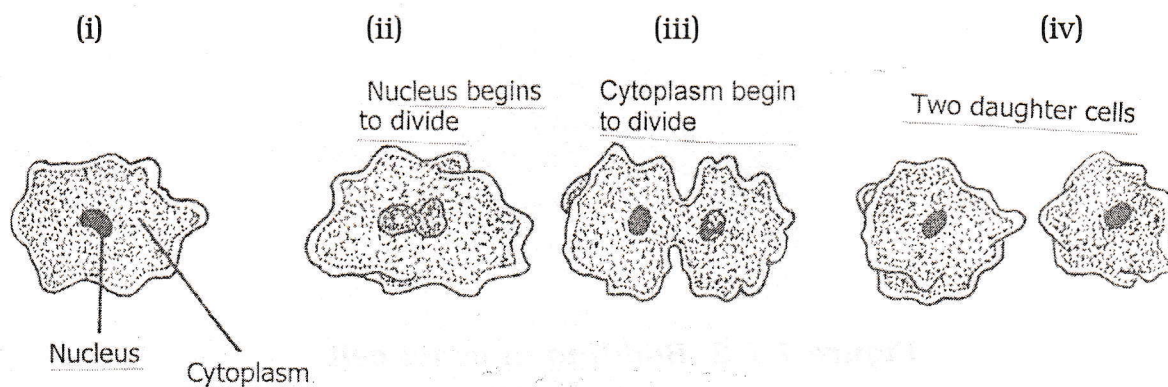
Dear learner can you mention organisms which reproduce asexually? For more information on this let us discuss different types of asexual reproduction.

### **Types of asexual reproduction**

#### **(a) Binary fission**

This is the process whereby an organism divides into two equal parts and each part grows to attain the original size of the parent cell and hence become a separate and independent organism.

Organisms which undergo this kind of reproduction are; Amoeba, Paramecium, Euglena, Trypanosoma and Bacteria.



**Figure 7.1.1: Binary fission in Amoeba**

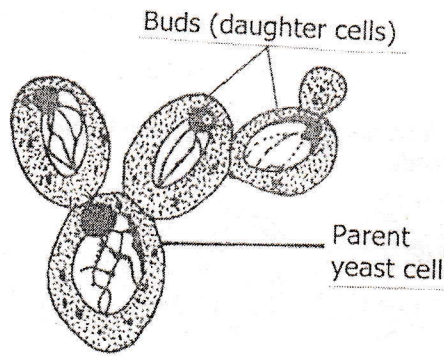
**(b) Sporulation/multiple fission**

This is the type of reproduction where organisms reproduce by forming spores. Organisms which reproduce under this method include, fungi, mosses and ferns.

Under favourable conditions, each of these spores germinates and grows into a new organism. In fungi, mosses and ferns, the spores arise in specialized structures called sporangia (in fungi), capsule (in mosses) and sori (in ferns).

**(c) Budding**

In this type of asexual reproduction, a new organism arises as an outgrowth bud on the older organism. The bud finally separates from the parents body and grows to attain the size of the parent. An example of organisms which undergo this type of reproduction is yeast.



**Figure 7.1.2: Budding in yeast cell**

### **Vegetative Propagation**

The most common type of asexual reproduction in plants is called **vegetative propagation or vegetative reproduction**

It is a form of asexual reproduction in some parts of the plants (not specialized for reproduction) which grow and become separated as independent plants. These parts must have buds.

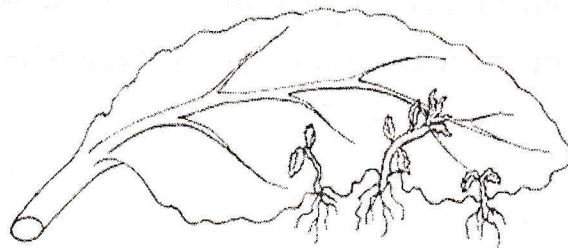
Example; bulb, rhizomes / stem tubers, root tubers and leaves.

Vegetative propagation can occur naturally, natural vegetative propagation or induced by human, artificial vegetative propagation.

### **Adventitious buds in leaves**

A series of adventitious buds develop on the leaf margin. Each of these buds can develop into a new plant.

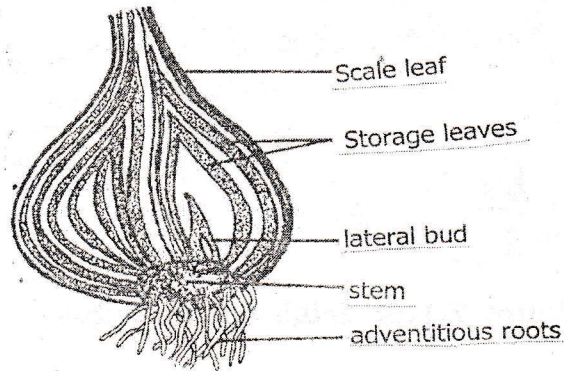
Example; Bryophyllum leaves.



**Figure 7.1.3: Bryophyllum leaf**

## **Bulbs**

These are condensed shoots with fleshy leaves. It is an underground modified shoot. Their leaves store food e.g. onions.



**Figure 7.1.4: Onion**

## **Bulbils**

These are small aerial buds produced in the axils of leaves or branches. The bulbils fall to the ground and grow into new plants. Example; bulbils of garlic, sisal and pineapple.

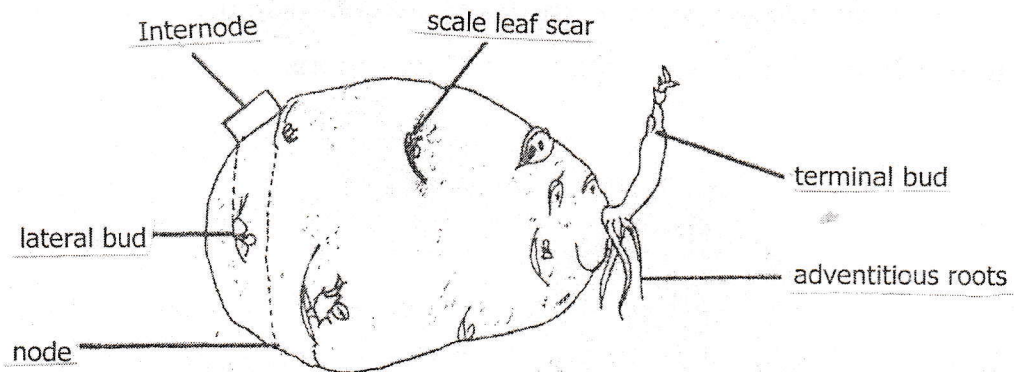
## **Tubers**

A tuber is an underground storage organ formed from a stem or a root.

### **Stem tubers**

These are stem structures produced at the tips of thin rhizomes (underground stems). Auxiliary buds in the axils of scale leaves grow into new plants.

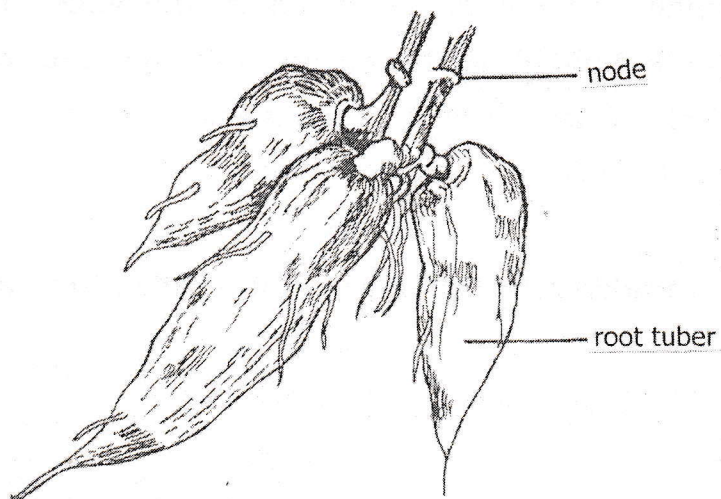
Example, Irish/round potato, ginger and sugar cane.



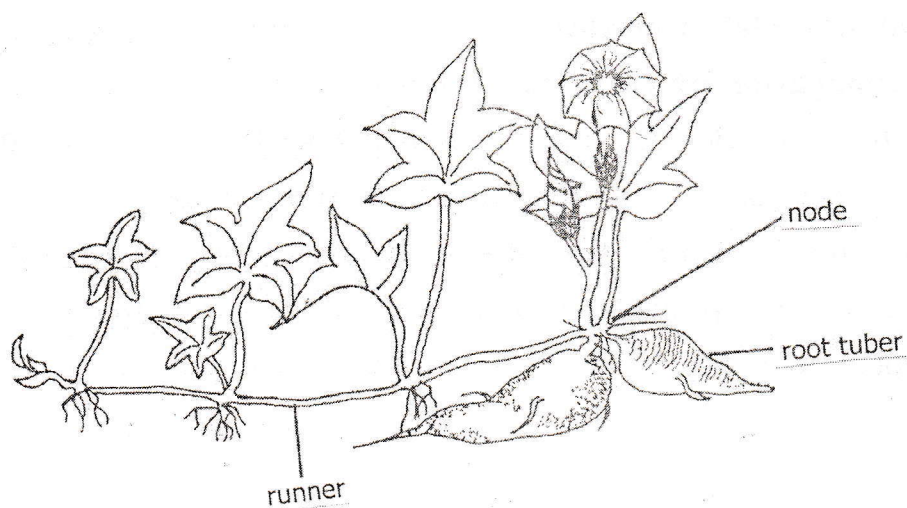
**Figure 7.1.5: Irish potato tuber**

**Root tubers:**

These are swollen underground roots. They are modified for storage. Cassava, carrots and beet roots are examples of root tubers.



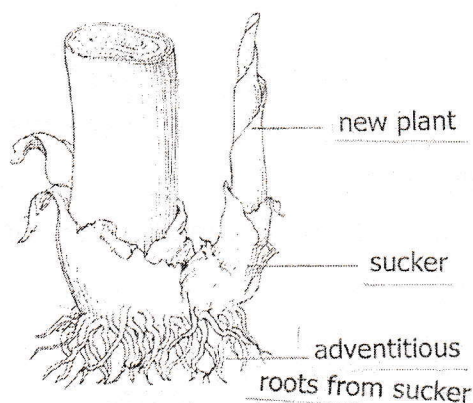
**Figure 7.1.6: Cassava tuber**



**Figure 7.1.7: Sweet potato runner**

**Suckers**

Plants such as banana are capable of reproducing through the formation of structures called suckers.



**Figure 7.1.8: vegetative propagation by means of suckers**

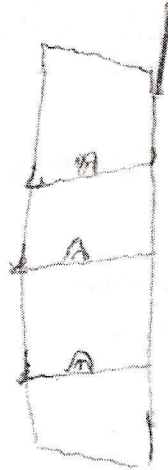
**Artificial Propagation**

Man however has found ways of introducing portions of a certain plant to grow and form a new independent plant. Since this practice is man made; it is referred to as artificial propagation.

## **Types of artificial propagation**

### **(a) Propagation by cuttings**

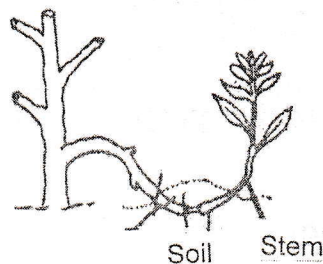
When a portion of a stem or root is cut off and put in a moist soil, it strikes roots and sprouts. A new independent plant is produced. Plants such as sugar cane, sweet potatoes and cassava are propagated by stem cuttings. Lemons and sweet potatoes can be cultivated by root cuttings.



**Figure 7.1.9: Propagation by Cutting**

### **(b) Propagation by layering**

A branch of a plant is bent down, fixed on the ground and covered with soil.

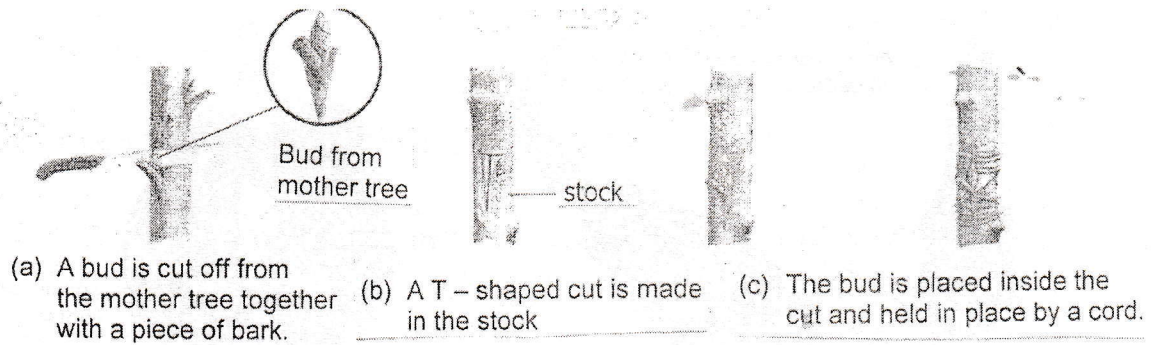


**Figure 7.1.10: Propagation by layering**

After sometime, the portion of the branch under the soil develops roots. If this branch is cut off from the main plant it develops into an independent plant. Examples of plants that can be propagated by layering are sweet potatoes.

**(c) Propagation by grafting**

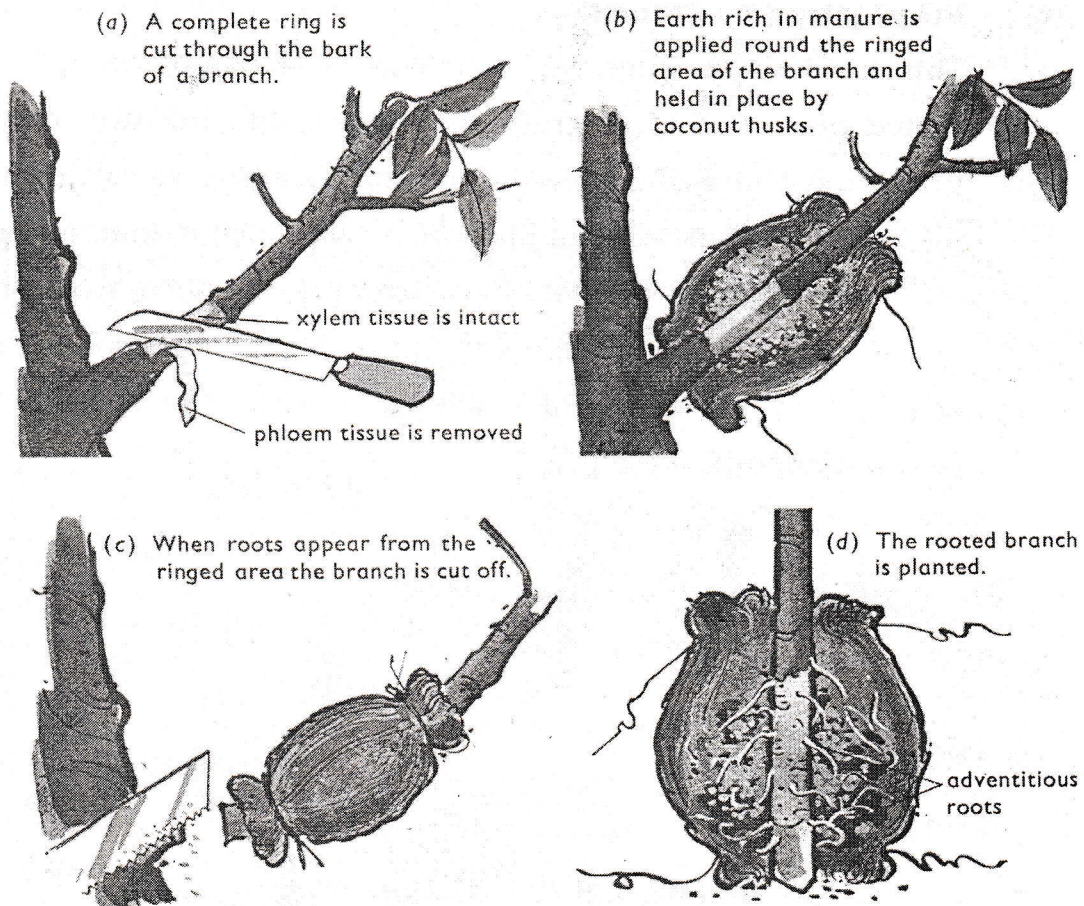
This involves the insertion of a part of a plant (scion) to a rooted plant (stock). If grafting is successful, the two plants unite and the grafted piece sprouts. Grafting is carried by plants of the same or related species and is common in orange and lemon (citrus) plants. For grafting to be successful, the xylem and phloem of both plants must be in direct contact to ensure easy movement of materials between the two plants (water, minerals and food)



**Figure 7.1.11: Bud grafting**

**(d) Propagation by marcotting**

Practised in plants which are difficult to develop roots. Two rings are made to cambium level at distance of 5cm away and the bark is removed between the rings. Rich soil is applied on it and covered with coconut husk or banana leaves. The soil is regularly moistured and roots grow after some time. Cut off the branch and plant it as a new plant.



**Figure 7.1.12: Propagation by marcotting**

Advantages of asexual reproduction:

- Only one parent is required.
- Genetically identical offsprings are produced. They are also identical to their parents.
- Shows rapid dispersal and spread e.g. natural vegetative propagation.
- Results into production of a large number of new organisms within a short period e.g. bacteria and bread mould.

#### Disadvantages of asexual reproduction:

- There is no genetic variation among the offspring, no diversification and they may carry undesired qualities and diseases of the parents.
- Many spores fail to find a suitable place for germination and therefore energy is wasted to manufacture them, as they end up dying.
- If an organism spreads in one area, it may result in overcrowding exhaustion/depletion of nutrients and, competition for survival/struggle for survival.
- Reduction in vigour and strength in succeeding generations.

#### Advantages of sexual reproduction:

- Brings about genetic variation
- Better adapted for the land environment.
- Vigour and strength increases since the individuals are hybrids from two parents.

#### Disadvantage of sexual reproduction:

- There is a dependence on external agents such as wind, insects and water for pollination; this makes pollination more dependent on chance, particularly wind pollination.
- Two individuals are required in making the process.

#### **Sexual reproduction**

Sexual reproduction is the type of reproduction which involves the union of two gametes (male and female gametes). This type of reproduction produces offsprings that are genetically different from their parents.

### **Characteristics of sexual reproduction**

- Involves a female and male parent.
- Fertilization/combination of genetic information from two separate cells (gametes) each of which has one half ( $\frac{1}{2}$ ) of the original parent genetic information.
- Gametes for fertilization usually come from separate parents.
  - Female parent-produces an egg/ovum.
  - Male parent produces sperm.
- Both gametes are haploid, (n) with a single set of chromosomes.
- The new cell from fertilization is called a zygote, with two sets of chromosomes (diploid cell)  $2n$  by mitosis.

After you have understood characteristics of sexual reproduction, let us see how the cell divides from diploid to haploid state

### **Meiosis (Reproduction Division)**

Dear learner, in order for organisms to maintain the same number of chromosomes (thread-like structures) their diploid cell ( $2n$ ) has to divide into haploid state (n). This is the basis of meiosis. During fertilization the sperm which is haploid fuses with the ovum which is also haploid to form a zygote that is diploid. In this way the number of chromosomes in each species is maintained constantly. Otherwise, if there was no meiosis, during fertilization diploid cell ( $2n$ ) could fuse with another diploid cell ( $2n$ ) to form a zygote which is  $4n$ . This could be another species of organisms.

The following information notes on meiosis will help you to better understand the concept. Welcome.

Meiosis is a form of nuclear division in which the chromosome number is halved from the diploid number ( $2n$ ) to haploid number ( $n$ ). It involves DNA replication during interphase followed by two cycles of nucleus divisions and cell divisions, known as meiosis I and meiosis II.

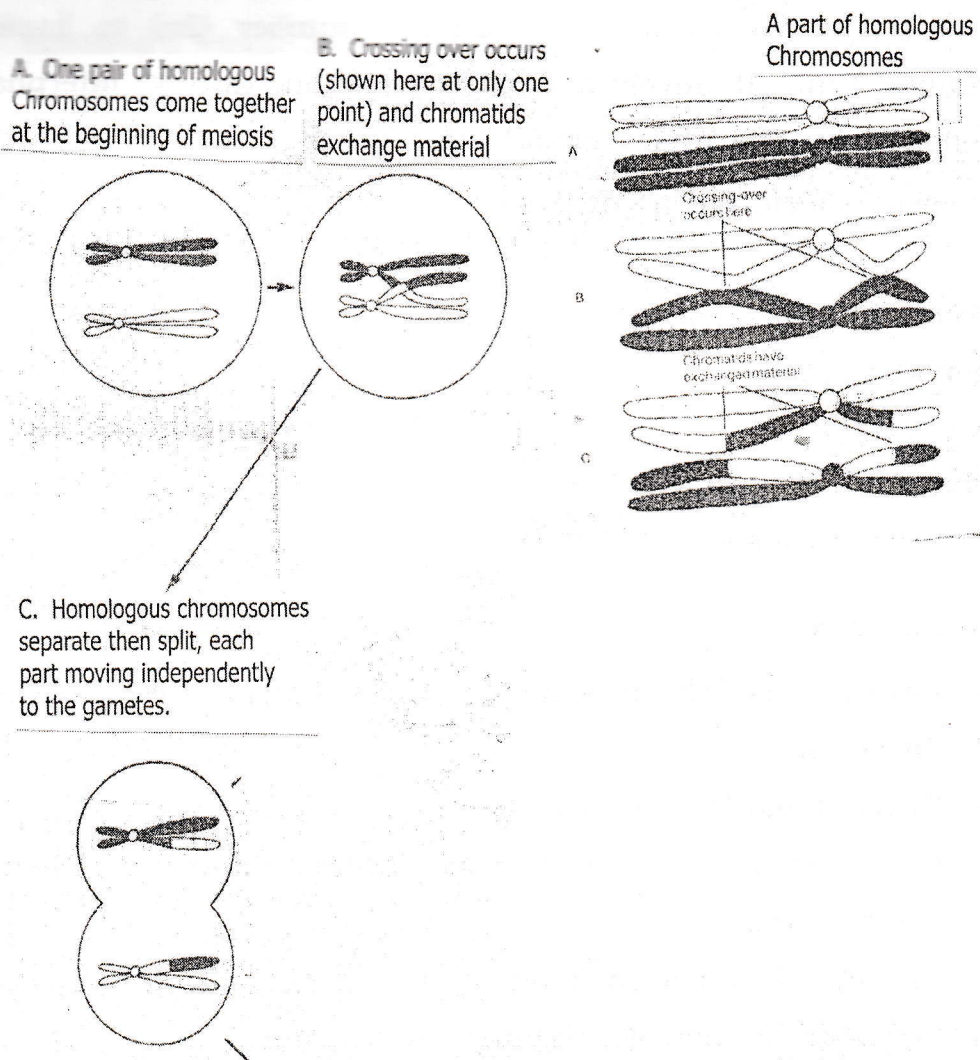
Meiosis occurs during the formation of sperms and eggs in the gonads.

### **Meiosis I**

Stages of meiosis:

#### **Prophase 1**

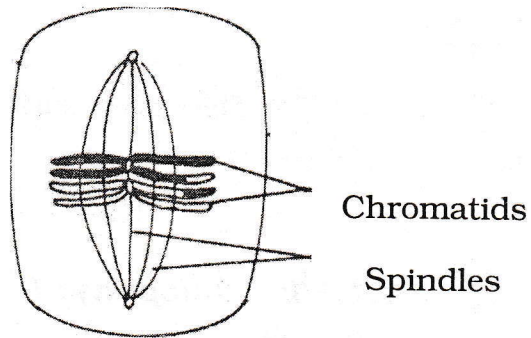
- Homologous chromosomes attract each other to form bivalents.
- Bivalent shorten and thicken.
- Chromosomes replicate to form chromatids (but attached at centromere).
- Chromatids repel each other except at chiasmata (crossing over point – where genetic material exchange).
- Chromatids break and rejoin in such a way that sections of male and female chromatids are exchanged.
- Nuclear membrane still intact i.e. all changes occur in the nucleus.



**Figure 7.1.13: Prophase 1**

**Metaphase 1**

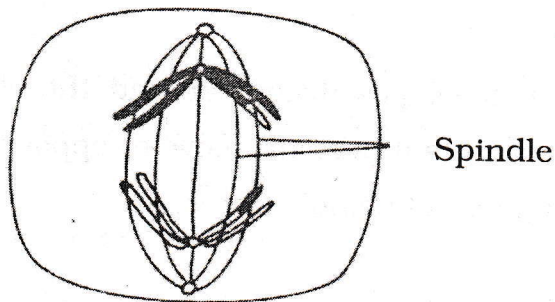
Bivalents become arranged around the equator of the spindle while attached by their centromere.



**Figure 7.1.14: Metaphase 1**

**Anaphase 1**

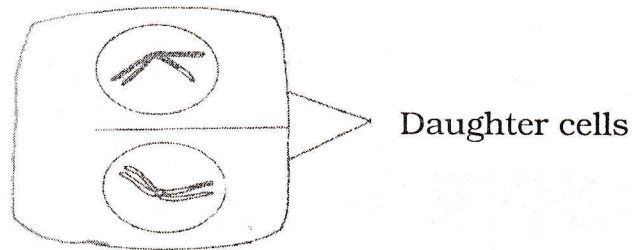
Spindle fibres pull homologous chromosome towards opposite poles. Chromosomes separate into two haploid sets. One set at each end of the spindle.



**Figure 7.1.15: Anaphase 1**

**Telophase 1**

- Homologous chromosomes arrive at opposite poles (end of meiosis 1).
- Chromosomes halved but still composed of two chromatids. (beginning of meiosis II)



**Figure 7.1.16: Telophase 1**

## **Meiosis II**

The chromosome number remains the same; the cells divide and result in four cells. Meiosis II is similar to mitosis except that there is no duplication of DNA during the interphase that may not occur between the two divisions.

### **Prophase II**

The nucleoli and nuclear envelopes disappear and the chromatids shorten and thicken. Centrioles if present, move to opposite poles of the cells, followed by formation of spindle fibres.

### **Metaphase II**

- Chromosomes align separately along the equator.
- Spindle fibres form and attach to each centromere, extending from one pole to the other.

### **Anaphase II**

The centromeres divide and spindle fibres pull the chromatids to opposite poles centromeres first.

## **Telophase II**

- Chromosomes uncoil, become longer and thinner.
- Nuclear envelopes and nucleoli re-form around each set of chromosomes/nucleus.
- New cell walls form between the four sets of chromosomes in case of plants and cleavage in animal cells.
- Each set of chromosomes in the four new cells, has exactly half the number of chromosome of the original parent cell (haploid).

## **Summary of meiosis**

As a result of meiosis, four daughter cells are formed from one parent cell. These are the gametes. Each daughter cell has half the number of chromosomes of the parent cell. Usually the parent cell is diploid ( $2n$ ) and the daughter cells are haploid ( $n$ ). The daughter cells are genetically different from each other and from their parents.

## **Significance of Meiosis**

- Causes formation of gametes/sex cells for sexual reproduction
- Maintains diploid number ( $2n$ ) of chromosome in successful generations
- Brings about genetic variation in the offspring produced by fusion of the gametes. Variation is due to crossing over in meiosis 1 and independent assortment of chromosomes.

### **ACTIVITY 7.1.1**

1. What do you understand by the term meiosis?
2. What is the importance of meiosis in the life cycle of organisms like human beings?
3. Compare meiosis 2 to mitosis.

## 7.1.2 REPRODUCTION IN HUMANS

Sexual reproduction in mammals involves the fusion of gametes. The fusion of two gametes is called fertilization, and the resulting cell which grows into the new individual is called a zygote. Each gamete contributes half of the genetic material present in the zygote and, hence, in the new individual. Half of the genetic material is provided by the mother and half by the father.

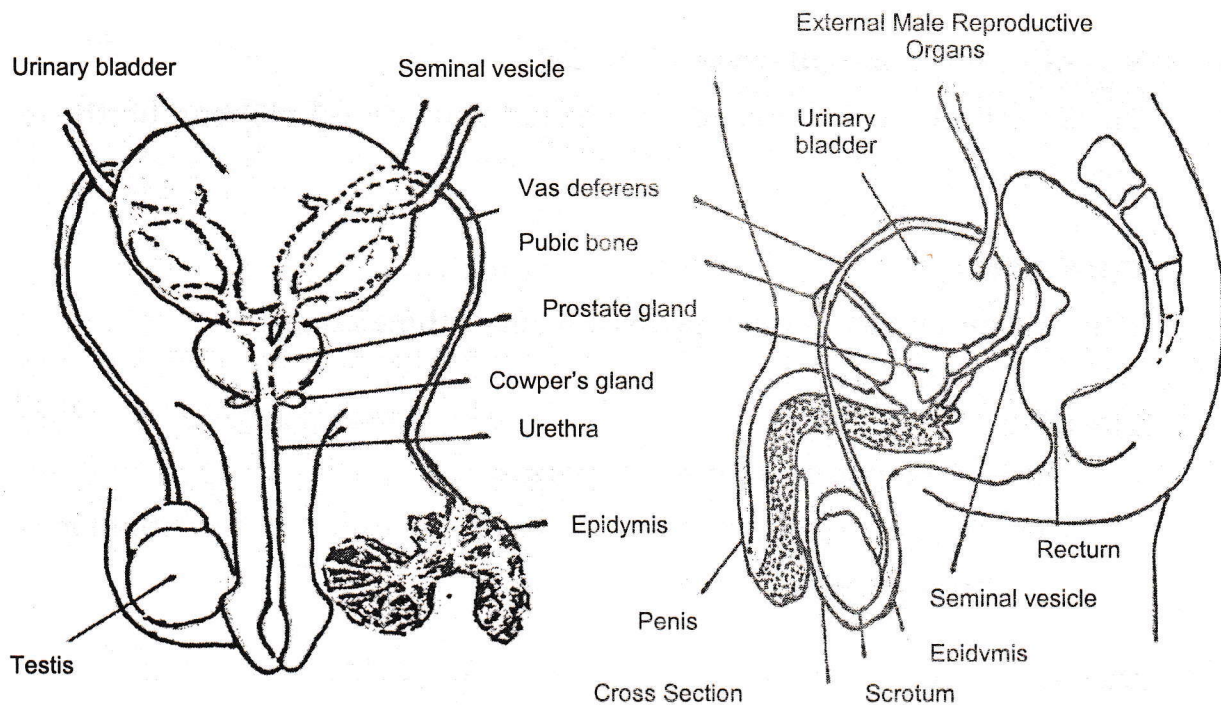
### **Mammalian Reproductive System**

#### **The male reproduction system**

Dear learner, human beings are either males or females. You are also a human being probably male or female. Can you list down the features/organs which make somebody to be male? What is the role of each feature/organ you have mentioned? If you know male reproductive system we congratulate you. If this is not clear to you below is some information about male reproductive system.

The reproductive system of the male has two major functions:

- Production of sperms
- Production of Hormone.



**Figure 7.1.20: Male reproductive organs**

**Scrotal sac: (Singular Scrotum)**

The skin sac situated outside the abdomen cavity in which testes are found. This is important because sperm cell develops well at a temperature 2 – 3° C lower than the main body temperature.

**Testes (singular: testis)**

These are two organs suspended from the body cavity.

Functions

- Is the site where the male gametes or sperm, are made.
- Produces the male sex hormone called testosterone.

**Seminiferous tubules**

These are long tubules that compose testes. The walls of tubules produce the sperms.

### **Vas efferentia (singular vas efferens)**

These collect sperm inside the testis and transfer them to the epididymis.

### **Epididymis**

This is a much coiled tube, pressed against the testis.

#### Functions:

- It is a temporary storage of sperms.
- Chemicals produced by the lining of the tube are essential for maturation of the sperms.

### **Vas deferens**

Is a straight tube which carries sperm to the urethra.

Most of the sperm are stored in the vas deferens.

### **Urethra**

Is a tube which carries urine from the bladder as well as sperm from the vas deferentia.

**Penis** Is an organ for copulation and passage of semen.

### **Seminal vesicles**

Are two structures found below the urinary bladder. They store sperms.

### **Prostate gland**

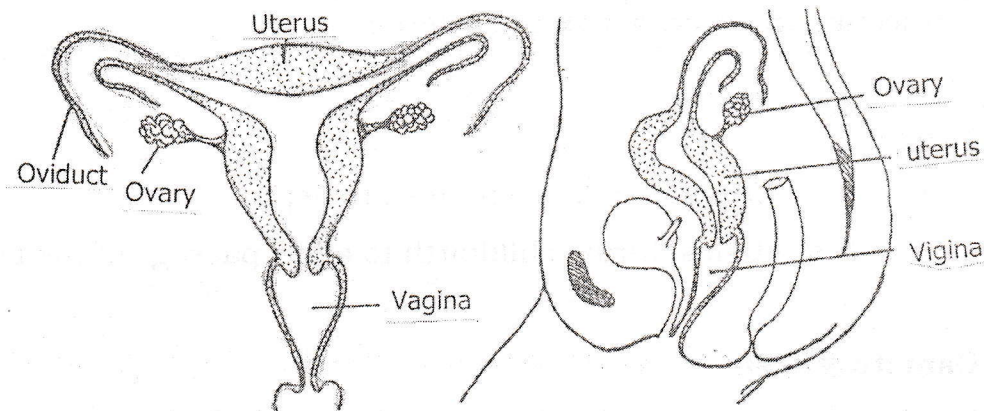
This gland produces an alkaline fluid that helps to neutralize the acidity of the vagina making the sperm more active.

### **Cowper's gland**

This gland secretes mucus and alkaline fluid into the urethra. The alkaline fluid neutralizes the acidity of any remaining urine.

## The Female Reproductive System

The responsibility of the female mammal for successful reproduction is considerably greater than that of the male because in the female uterus, the zygote grows into a full being at the expense of the mother. The mother then gives birth to the baby lactating it after birth and other parental care activities.



**Figure 7.1.21: Female reproductive organ**

**Ovaries:** Are structures situated near each kidney. Ovaries produce eggs or ova and secrete the female sex hormones.

**Fallopian tube or oviduct:** Is a tube with a funnel shaped opening. The tube carries eggs from the ovary to the uterus. It is in this tube that ova or eggs are shed and fertilized.

**Uterus:** Is a structure that lies behind the bladder. If fertilization has taken place, the embryo implants in the wall of the uterus and grows until birth.

**Cervix:** Is the narrow entrance to the uterus from the vagina. It is normally blocked by a plug of mucus and a ring of muscle that prevents the developing foetus from coming out before the right time for delivery. It also allows the baby to pass through during birth.

### ACTIVITY 7.1.2

1. Draw large, well labelled diagrams of the male and female reproductive systems.
2. Summarise the key function(s) of each part.

**Vagina:** Is a posterior part of the female reproductive duct connecting the uterus with the exterior.

Function:

- It is the region where sperms are deposited.
- It stretches during childbirth to allow passage of the baby.

### Gametogenesis

I hope you remember that human cells have 46 chromosomes. You also know that in sexual reproduction, two individuals are involved. Male produces sperm and female produces ovum. These come from cells with 46 chromosomes.

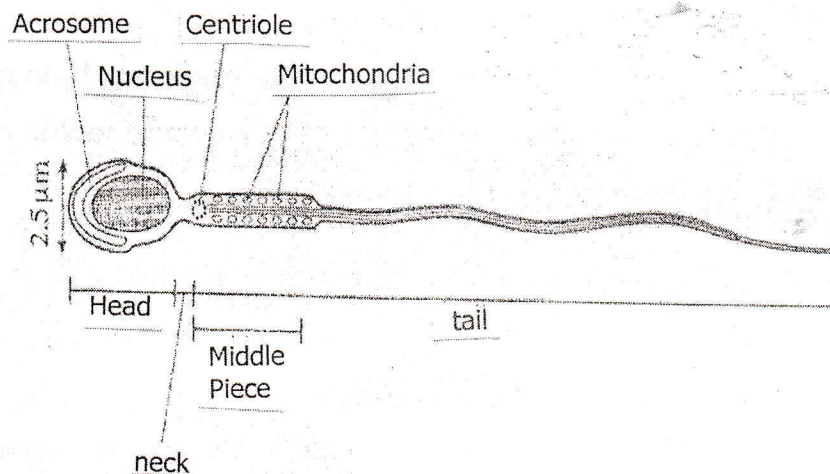
Can you suggest how they break so that half of number of chromosomes is attained?



The following explanation will tell you how gametes are formed. Gametogenesis is the production of gametes. There are male gametes known as sperms and female gametes known as eggs. Production of sperms is called *spermatogenesis* and production of eggs is called *oogenesis*. Both processes take place in the gonads, namely the testes in males and the ovaries in females. In the gonads there are primordial germ cells which divide repeatedly by mitosis to produce daughter cells. These daughter cells grow and divide by meiosis to produce gametes.

## Spermatogenesis

The production of sperms is called spermatogenesis. This process takes place in seminiferous tubule of testis. The seminiferous tubule has a wall with an outer layer of germinal epithelial cells and layers of cells produced by repeated cell divisions of this layer. The first divisions of the germinal epithelial cells give rise to many spermatogonia which increase in size to form primary spermatocytes. These undergo the first and second meiotic division to form spermatids, the spermatids differentiate into sperms.



**Figure 7.1.22: Structure of a mature human sperm**

**The head:** The head consists of: an acrosome and nucleus.

### Acrosome

Produces enzymes which help the penetration of the sperm into the egg (ovum) by digesting the ovum membrane.

**Nucleus:** Controls the activities of the sperm cell.

**Neck:** Possess centrioles to assist in division of the zygote

### Middle piece

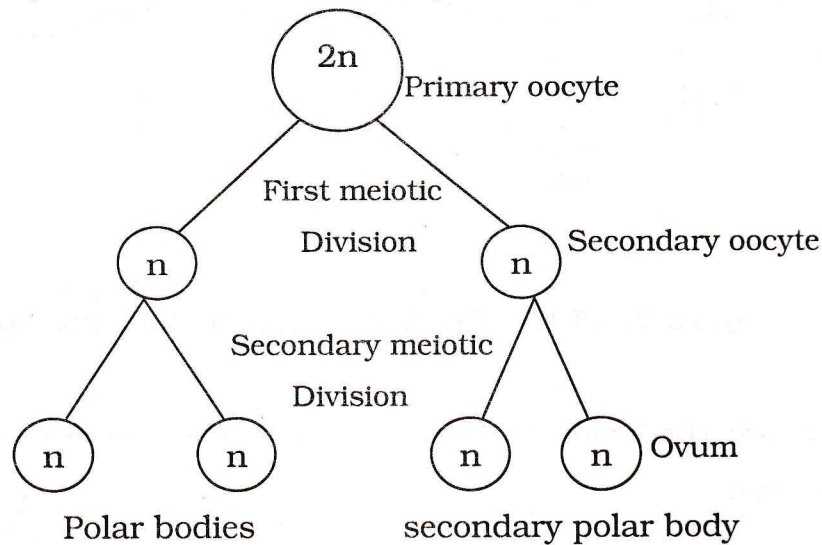
Consists of many mitochondria: Mitochondria is a site for respiration. It gives sperm energy for moving in the female reproductive tract.

### Tail

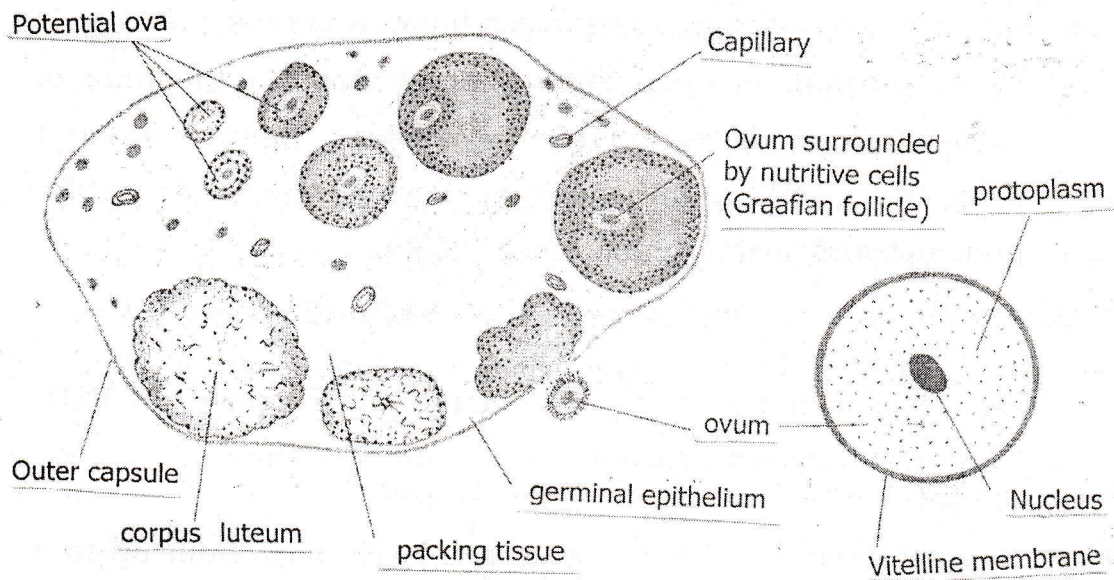
To propel the sperm towards the oviduct and to orient the sperm ready to enter the ovum.

### Oogenesis

Oogenesis is the formation of eggs. A primordial germ cell of the ovary is divided repeatedly by mitosis to produce oogonia which are diploid cells. Oogonia divide mitotically to produce diploid primary oocytes. After meiotic division each primary oocyte yields one ovum and three polar bodies which are haploid.



**Figure 7.1.23 A: Oogenesis**



**Figure 7.1.23 B Oogenesis**

### **Menstrual cycle**

In module 6, under hormonal coordination, we discussed different hormones and their functions. Do you remember roles of oestrogen and progesterone? Are there any other reproductive hormones which take part in females body? Do you remember that if their concentration is altered they behave differently? In females, alterations of hormones especially those concerned with reproduction set up a cycle known as menstrual cycle. The following information will give you more details about menstrual cycle.

In the females, hormones are not constantly secreted but are secreted in cycles which last for about 28 days.

### **Events**

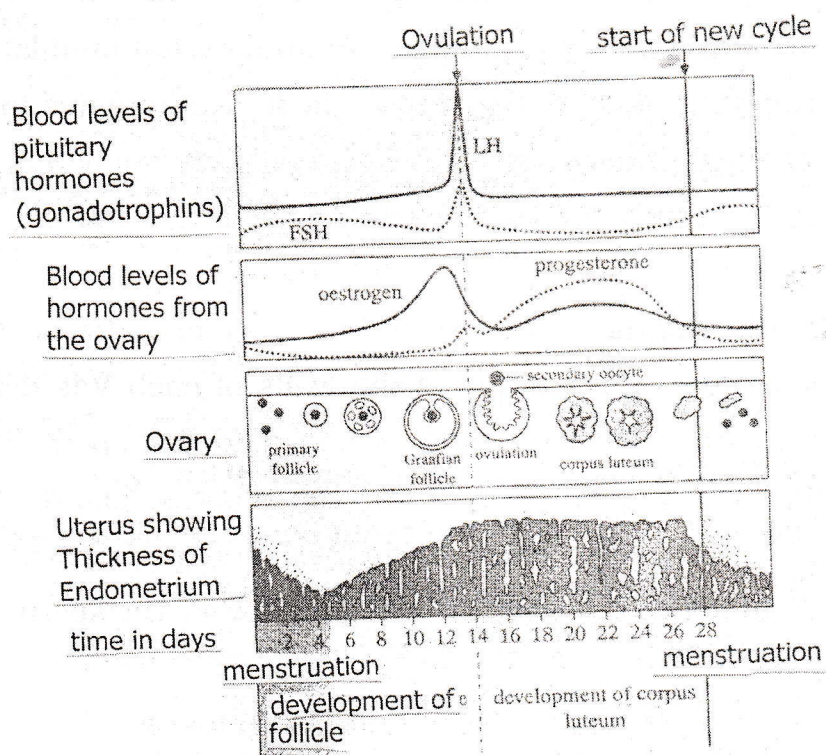
- The anterior pituitary gland secretes follicle stimulating hormones (FSH) into blood. Blood transports it to the ovaries.
- The FSH stimulate the development of several follicles; only one of which will complete development.

- Cells of developing follicles start to produce the female sex hormone called oestrogen. Oestrogen has two targets:
  - Uterus: stimulates the repair and development of the lining of the uterus ready to receive the embryo (implantation) if pregnancy occurs. The embryo normally implants in the endometrium layer of the uterus.
  - Anterior pituitary:  
Oestrogen inhibits the pituitary gland not to secrete any FSH. This ensures that, only one egg (ovum) is produced at a time.
- At the midpoint of the cycle, oestrogen levels have built up to a high level which triggers the secretion of luteinizing hormone (LH).
- The target of LH is the ovary where it stimulates ovulation. Ovulation refers to the release of secondary oocyte (mistaken as ovum) from the Graafian follicle. Normally only one oocyte is released each month by one of the ovaries so that ovulation alternates between the pair of ovaries.
- The remaining part of the Graafian follicle is stimulated by LH so that it develops into Corpus luteum (yellow body).
- The corpus luteum continues to secrete oestrogen, as well as another hormone called progesterone.
- Progesterone stimulates the uterus to maintain its thickening and stimulates glandular activity. The release of progesterone is associated with a rise in body temperature of the female just after ovulation.

- If fertilization does not take place, the corpus luteum degenerates and the level of oestrogen and progesterone drops. This causes the constriction of blood vessels within the thickened portion of the uterus endometrium breaks down, causing menstruation. Its epithelial cells, mucus and a small amounts blood are discharged out through the vagina. This period is called *menstruation* and the discharge is called the menstrual flow. Menstruation usually occurs after 28 days (i.e. lunar month) and it lasts for 3 – 5 days.

However the duration of menstruation varies among the females.

See fig. 7.1.24



**Figure 7.1.24: Menstrual cycle**

### Sexual intercourse

Sexual intercourse is an important act of human sexual behaviour. It is usually accompanied by much pleasure for both partners, which

forms the basis of the strong bond which develops between sexual partners. Sexual intercourse may result in pregnancy and is a component of reproduction.

### **Copulation**

In the previous section we learnt how gametes (male) are deposited in the female. Do you know what happens to the gametes? In this section we are going to learn how they contribute in forming a new organism.

For fertilization to occur, sperms must be deposited in the vagina within a few days before or a day or two after ovulation. Sperms transfer is accomplished by copulation. Sexual excitation dilates the arterioles supplying blood to the penis. Blood accumulates in three cylindrical spongy sinuses that run lengthwise through the penis. The resulting pressure causes the penis to enlarge and erect and thus able to penetrate the vagina. Movement of the penis back and forth within the vagina causes sexual tension to increase to the point of ejaculation. Contraction of the walls of each Vas deferens propels the sperms along. A fluid is added to the sperm by the seminal vesicles, Cowper's glands, and the prostate gland. These fluids provide a source of energy (fructose) and perhaps in other ways provide an optimum chemical environment for the sperms.

The mixture of sperm and accessory glands' fluids is called semen. It passes through the urethra and is expelled into the vagina.

### **Fertilization and human development**

Fertilization is the fusion of the sperm and egg nuclei. It usually occurs in the upper third of the oviduct. Thirty minutes after ejaculation, sperms are present in the oviducts, having travelled

from the vagina through the uterus and into the oviducts. Sperms travel this distance by the beating of their flagellum. Of the several hundred million sperms released during ejaculation, only a few thousand reach the egg.

Only one sperm will fertilize the egg. One sperm fuses with receptors on the surface of the secondary oocyte, triggering a series of chemical changes in the outer oocyte membrane that prevents any other sperms from entering the oocyte. The entry of the sperm initiates meiosis II in the oocyte. Fusion of the egg and sperm nuclei forms the diploid zygote.

### **Stages of Gestation**

The period of time from fertilization to birth (usually 9 months) is divided into trimesters, each about three months long. During pregnancy, the zygote undergoes 40 to 44 rounds of mitosis, producing an infant containing trillions of specialized cells organized into tissues and organs.

### **The First Trimester**

Cellular differentiation begins to form organs during the third week. After one month the embryo is 5mm long and composed mostly of paired somite segments. During the second month the major organs system form e.g. limb buds develop. The embryo becomes a foetus by the seventh week. Beginning the eighth week, the sexually neutral foetus activates gene pathways for sex determination, forming testes in XY foetus and ovaries in XX foetus. External genitalia develop.

### **The Second Trimester**

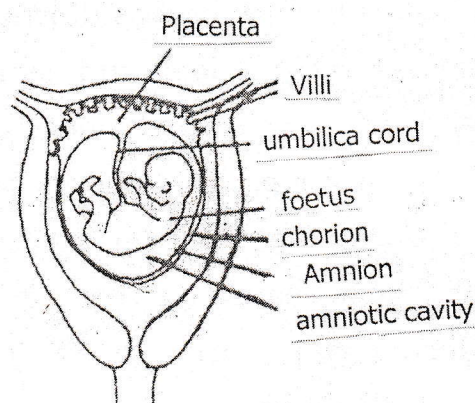
The foetus increases in size during this trimester, and bony parts of the skeleton begin to form. Foetal movements can be felt by the mother.

### **The last Trimester**

During this trimester, the foetus increases in size. Circulatory and respiratory systems mature in preparation for air breathing. Foetal growth during this time uses large parts of its mother's protein and calcium intake. Maternal antibodies pass to the foetus during the last month.

### **Implantation**

The uterine lining becomes enlarged and prepared for implantation of the embryo in the trophoblast layer. Twelve days after fertilization, the trophoblast has formed a two - layered chorion. Human chorionic gonadotropin (hCG) is secreted by the chorion, and prolongs the life of the corpus luteum until the placenta begins to secrete estrogen and progesterone.



**Figure 7.1.25 Embryo and its placenta**

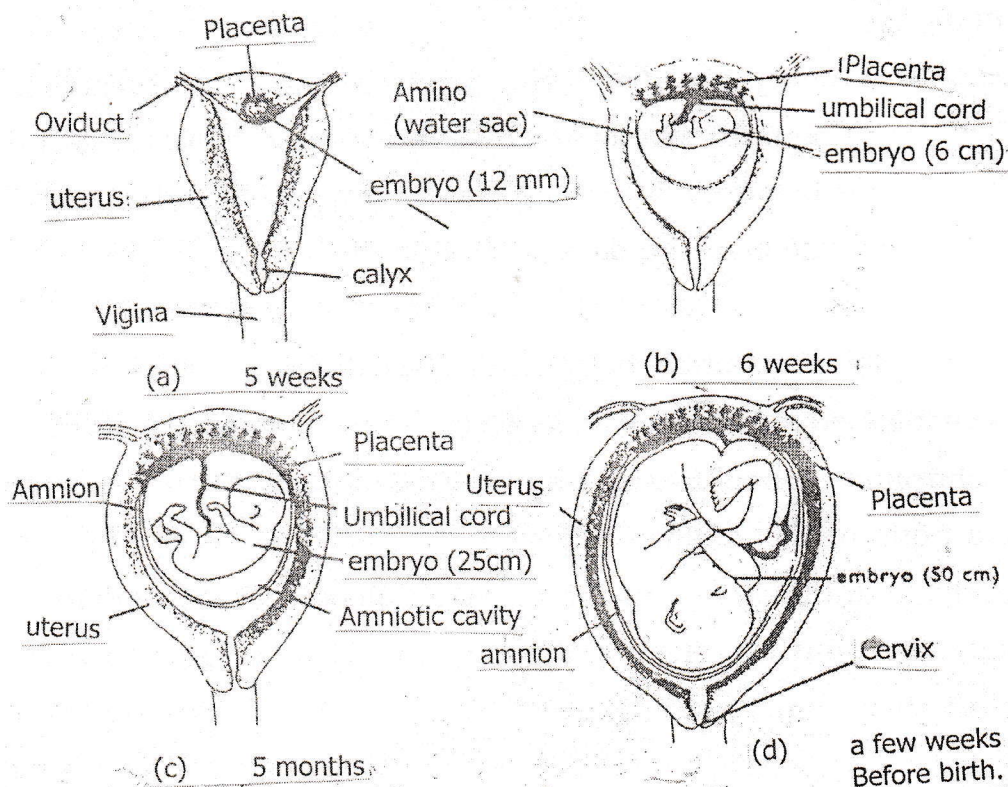
## **The Placenta**

Maternal and embryonic structures interlock to form the placenta, the nourishing boundary between the mother's and embryo's blood. Although there is normally no mixing of the foetus and maternal blood supplies, the placenta does facilitate.

- The transfer of materials between the foetus and the mother.
- Receiving food substances and oxygen from the mothers' blood.
- Discharging carbon dioxide and other metabolic wastes such as urea from the foetal blood.
- Receiving antibodies from the mother's blood. These remain for weeks after birth, protecting the baby from the diseases to which the mother is immune.

The placenta is not simply a transfer device. Using raw materials from the mother's blood, it synthesizes large quantities of proteins and also some hormones. The metabolic activity of the placenta is almost as great as that of the foetus itself.

The umbilical cord connects the foetus to the placenta. It receives deoxygenated blood from the iliac arteries of the foetus and returns oxygenated blood to the liver and on to the inferior vena cava of the foetus. The fluid filling the amnion sac is called amniotic fluid. This, acts as a shock absorber, hence preventing the foetus from injuries caused by mechanical activities of the mother.



**Figure 7.1.26 Different stages of human embryonic development**

**Birth** Is the emergence of the baby or other young's of mammals from the body of the mother. This process occurs in the following stages.

### **First stage**

The first stage of birth lasts from beginning of contractions to the full (10 cm) dilation of the cervix. Membranes of the amniotic fluid rupture lubricate and fluid is released through the vagina.

### **Second Stage**

Strong repeated contractions of the uterine muscles propel the foetus down the vagina/birth canal. At the same time, abdominal muscles relax thus enhancing the process of giving birth.

The strong contraction of the uterine muscles is called **labour**

The whole process of birth is controlled by **oxytocin hormone**.

## **TEST TUBE BABIES**

Some women have blocked or deformed oviducts. If this happens, fertilization cannot take place. A modern scientific technique known as test-tube baby can help them to get babies.

Ripe ova (one or more) are sucked from a woman's ovaries using special syringe inserted into her abdomen. The ova are placed in a dish (or test - tube) containing sperms from her partner and kept warm for four hours. Fertilization occurs in the dish or test-tube and embryos are formed. One embryo is then inserted into the woman's womb where it will be implanted and develop into a baby.

## **Artificial insemination**

This is a process whereby sperms are introduced into the vagina by physician. Sperms are introduced during ovulation.

### Advantages:

- Women can choose the father of her children by buying stored sperms.
- Is helpful if the husband has a low sperm count. The sperms can be collected over a period of time and concentrated so that the sperm count is sufficient to result in fertilization.
- Men who are far from their wives can send sperms to their wives and bear children without sexual intercourse.
- Sperms can also be stored for future use. Even if a husband dies, a woman can go on bearing children.

## **Multiple pregnancies**

Multiple pregnancies occur when a woman delivers more than one baby. In human beings, multiple pregnancies are not very common and when they occur, the occasion is considered abnormal.

If a woman has two babies at once, she has twins, if three, these are triplets and if four these are quadruplets. Multiple pregnancies are common in many other animals, for example, - cats, dogs, pigs and rats.

## **Causes of multiple pregnancies**

- When two or more egg cells (ova) are released and fertilized
- When the ball of cells which develops from a fertilized cell splits into two or more.

## **Twins**

Twins occur, when two embryos develop in the uterus.

## **Types of twins**

There are two types of twins:

1. Identical twins.
2. Fraternal twins (non-identical twins).

## **Identical twins**

This occurs when one egg is fertilized and then splits into two cells. These cells do not stay together but separate into two parts. Each part develops into a foetus. They have the same characteristics and sex. It is difficult to distinguish them.

## **Fraternal twins**

Occurs when two eggs are released at the same time from either one or both ovaries and are fertilized. The twins are different in characteristics. They may be of the same or different sex.

## **Maternal and child care**

This involves the expectant mother to care for the new born baby. Maternal and childcare is very important as it involves the caring of the new born baby to ensure that it survives and grows into a healthy adult.

The baby must be kept clean, warm and breast fed. Breast feeding must be strongly encouraged as it is important for the survival of the baby.

### The advantages of breast feeding:

- Both colostrum and breast milk contain antibodies and living cells which destroy germs. This helps babies to fight early infections such as those which cause diarrhoea, nappy rash and bronchitis.
- Breast milk is pure and fresh and its contents are constantly changing to exactly meet the needs of a growing baby. Moreover, it is available, the moment it is needed.
- Breast milk is digested more quickly and easier than bottle milk which is why breast - fed babies rarely suffer from constipation.
- There is evidence that, chemicals in breast milk aid development of the central nervous system.

### Disadvantages of bottle feeding:

- Bottle milk is expensive.
- Unless the bottle is carefully cleaned, sterilized and pure water used to dissolve milk powder, germs can be transmitted to the baby.

## **Complications of the Reproductive System**

When you plan for a journey, let us say to a National Park, you expect everything to go on well. Sometimes problems may arise, for example car accident, floods or theft. Some of these problems may affect the whole plan and even cause a great and permanent effect like losing part of your body due to an accident.

Reproductive system may face complications and become very harmful. Here are some of those complications. Some pregnant women face complications of the reproductive system leading to abortion/miscarriage, still birth and ectopic pregnancies. Such complications have negative effects on women's lives.

### **Abortion**

This is the termination of pregnancy before the baby is fully grown. Usually a baby is born after about 36 to 40 weeks of pregnancy. When a baby is born in less than 36 weeks, it is described as a premature birth.

### **There are two types of abortions**

1. Spontaneous abortion (miscarriage).
2. Induced abortion.

### **Spontaneous abortion**

It is also known as miscarriage. A miscarriage is the loss of a developing embryo before the 28<sup>th</sup> week of pregnancy.

It occurs when the foetus is expelled from the uterus without being induced by any means. One of the first signs that a miscarriage may occur is bleeding from the vagina.

### **Causes of spontaneous abortion**

Spontaneous abortion could be caused by:

- Hormonal imbalance. The hormones which are responsible for ovulation and pregnancy work in conflict with each other.
- An abnormal uterus (Under developed) or incapable uterus which cannot take pregnancy to fully term.
- Some diseases and infections such as syphilis, malaria, German measles.
- Heavy work load done by the mother during early pregnancy.
- Injury to the mother's abdomen caused by a fall or kick.
- Emotional stress or shock e.g. when the mother hears some bad news.
- The development of a deformed embryo.
- Failure of the placenta to develop to sufficient size.

### **Still birth**

A pregnant woman has still birth if the baby dies before, during delivery or a few hours after delivery.

### **Causes of still birth**

Some of the factors which cause still birth include:

- Using harmful drugs, such as alcohol and cigarettes.
- Accidents or severe falls.
- Severe malnutrition.
- Anaemia.
- Physiological factors such as those, which cause high glucose levels in the blood (diabetes mellitus).
- A narrow pelvis that causes difficulties during delivery.
- Strangulation of the baby by the umbilical cord during delivery.

### **Effects of still-birth**

An individual who suffers from still-birth may experience the following:

- Psychological suffering due to loss of the baby.
- Complications such as blood loss.
- Complications such as blood pressure.
- Suffers physical health.

### **Ectopic Pregnancy**

This is an implantation of the zygote in a location other than the uterus. In most cases, it takes place in the fallopian tube if the fertilized ovum does not reach the uterus within seven days. Sometimes ectopic pregnancy occurs in the abdominal wall.

### **Causes of ectopic pregnancy**

Ectopic pregnancy can be caused by inflammation of the fallopian tube. The inflammation may be caused by infections and diseases of the reproductive system such as gonorrhoea, syphilis and cancer. These diseases cause semi or total blockage of the fallopian tubes.

### **Effects of ectopic pregnancy**

An individual who has an ectopic pregnancy may experience the following:

- State of fear on learning that she has ectopic pregnancy and that open operation is a must. This is so because ectopic pregnancy is dangerous and often leads to death if the mother can not access medical attention and check up regularly.
- Pains and later excessive bleeding, which may terminate the life of the mother.
- Scare of being pregnant and fear of subsequent pregnancies.

## **Life styles and social cultural factors which may cause complications of the reproductive system**

The above complications of the reproductive system which affect some women may be a result of failure to observe some basic principles for a healthy body. Ignorance and failure to adhere to hygienic principles and regulations that are interlinked with the manner in which individuals live; i.e. their lifestyles and social – cultural factors, contribute significantly to the complications of the reproductive system.

Below are some of the unprincipled lifestyle examples:

- **Sexual behaviour**

The sexual behaviour or activities that are conducted by some of the people increase the chances of getting infections and diseases, which may cause abortion, still – birth and ectopic pregnancy. The diseases include STDs and HIV/AIDS. The unwanted pregnancy may lead to abortion.

- **Hygiene of the reproduction system**

Poor hygiene of the reproductive system increases the chance of getting reproductive system infections. The latter lead to abortion, still birth and ectopic pregnancy.

- **Nutrition**

Malnutrition during childhood will show its effect in later ages. Abortion still – birth and ectopic pregnancies are likely to occur to a malnourished individual.

- **Drug and drug abuse**

Smoking cigarettes, excessive drinking of alcohol and other narcotics addictions have negative impact on the health of the foetus in the womb.

- **Heavy work**

In some societies, women continue to do heavy work even during the time of pregnancy. Heavy work puts women at a high risk of getting an abortion or still - birth.

- **Wife beating**

In some societies, wife beating is regarded as a normal practice for punishing the wife who differs with her husband. Kicking at the abdomen of a pregnant woman either intentionally or accidentally may result in abortion or still - birth.

- **Spouse inheritance**

This is one of the major causes of STDs and HIV/AIDS. This also causes complications of the reproductive system.

**Method of minimizing the occurrence of Abortion, Still - birth and Ectopic pregnancies**

The following are some of the measures that individuals and the community may take to minimize abortion, still - birth and ectopic pregnancy.

- Wife beating and violence against women should be condemned.
- Drug abuse should be avoided because it leads to unhealthy reproductive health.
- Pregnant women should know the benefits of taking a balanced diet for good reproductive health.
- Parental care of the pregnancy is very important to ensure safe birth, a healthy baby, a healthy mother and a happy father.

## **Family Planning**

Dear learner, you always hear people talking about family planning. Can you tell us the meaning of family planning? Why is it very important in life? If you are a parent which method of family planning do you use? Why? If you are a parent to be which method of family planning are you going to apply and why? In order to answer above questions very well it is important to the following information.

Family spacing is an individual's ability to decide freely how many children he or she may want to have and when he/she wants to stop having them.

Birth placing is the interval between one birth and the next. This space can be planned or unplanned. It is advised that birth spacing should be at 24 months (2 years) interval between births.

### **Importance of planning a family**

- Allows the mother to rest after giving birth,
- Provides more time for women to do other work to improve their lives,
- A human baby needs the most care for the longest time at least two years. If during this period the mother becomes pregnant this can lead to neglect or ill health of the child.

### **Methods used in Family Planning**

Natural family planning methods

All methods of natural family planning are based on keen awareness of natural signs and symptoms associated with each phase of the woman's menstrual cycle.

Natural methods include the calendar method, basal body temperature, billing method and withdrawal method.

### **Calendar or rhythm method**

This method requires charting and recording each menstrual period. By counting back the first day of woman's menstrual period, a woman can calculate the days in each cycle when an egg is likely to be around and can therefore be fertilized. Sexual intercourse is carried out during the safe period only.

### **The basal body temperature**

It involves the charting and recording of the body temperature immediately up on awakening. A very slight but observable drop of basal body temperature usually occurs 12 - 24 hours before ovulation and equally slight but sustained elevation of basal body temperature always follows ovulation.

### **The billing method**

It involves the interpretation of changes in cervical mucus over the course of menstrual cycle. Quality of the mucus is observed i.e. its ability to stretch, its transparency, its stickiness on touch are checked for indication of ovulation. On fertile days cervical mucus is abundant, clear and stretchy.

### **Withdrawal method**

The male interrupts intercourse by withdrawing the penis from the vagina just before orgasm, so that the full ejaculation of sperm is not delivered into vagina.

### Advantages of Natural family planning:

- Increases users knowledge of reproduction,
- Enhances self awareness and self reliance,
- Involves both partners,
- No cost.

### Disadvantages

- Does not provide protection against STDs/HIV/AIDs.
- Women must record carefully sign and symptoms for several months before they can rely on this method of contraception.
- Menstrual cycles, body temperature and cervical mucus can be affected by factors other than ovulation thereby giving misleading information.
- Not effective methods.
- Both partners cooperation is essential.

### **Barrier method**

Barrier method includes condoms, Intrauterine Contraceptive Devices (IUCDs), Diaphragm and the loop.

### **Condoms**

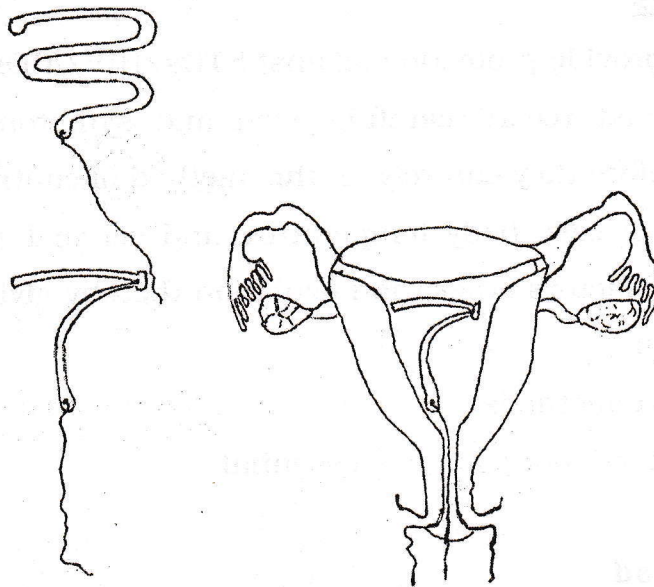
Condom is a thin sheath made of rubber (latex) that is put over the erect penis (male condoms) or put in the vagina (female condoms).

### **Intrauterine Contraceptive Devices (IUCDs)**

It is a little soft plastic device inserted in the uterus by a doctor or nurse. There are several types of IUCD.

The IUCD device prevents fertilization to occur by:

- Immobilizing the sperms and interferes with migration of sperm from vagina to fallopian tubes.
- Speeds transport of ovum through the fallopian tubes so that fertilization does not occur.



**Figure 7.1.27: Diagram of IUCD**

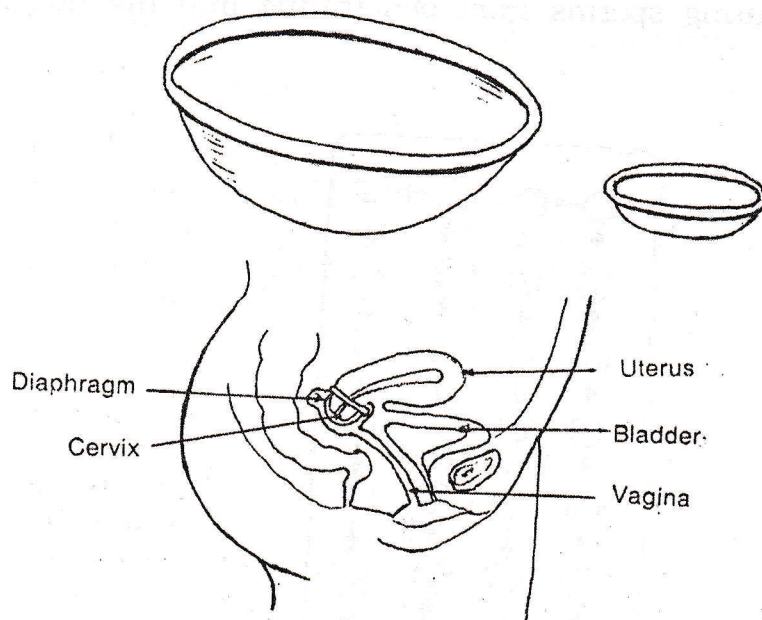
#### Disadvantages

- It requires a regular check up by a doctor or physician to see that it is still in place.
- Can be expelled unnoticed from the uterus.
- Does not protect against STDs or HIV/AIDs.

#### **Diaphragm**

A diaphragm is a contraceptive made of soft rubber and shaped like a cup to cover the cervix. A diaphragm is placed between the rear wall of the vagina and the upper edge of pubic bone.

It serves as a barrier to prevent sperm from entering the uterus.



**Figure 7.1.28: Diaphragms**

### **Hormonal methods**

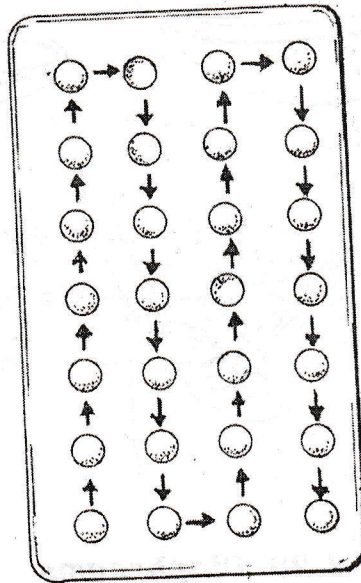
Hormonal methods include oral contraceptives, depo-provera, Norplants and injectables for females.

### **Oral contraceptives**

Oral contraceptives also known as birth pills are pills containing hormone that prevent ovulation. The pills contain hormones oestrogen and progesterone which interfere with the mechanisms of ovulation. These hormones also:

- Stop the mechanism which transports the ovum in the oviduct to the uterus.
- Prevent the preparation of the inner lining of the uterus for the implantation of the zygote

- Cause a thickening of mucus in the vagina making it sticky and thus preventing sperms from penetrating into the uterus and oviduct.



**Figure 7.1.29: Picture of contraceptive pills**

### **Norplant**

Norplant is a new form of a contraceptive capsule containing a steroid hormone, a synthetic progesterone that is slowly released over a time and prevents pregnancy by inhibiting ovulation and thickening cervical mucus.

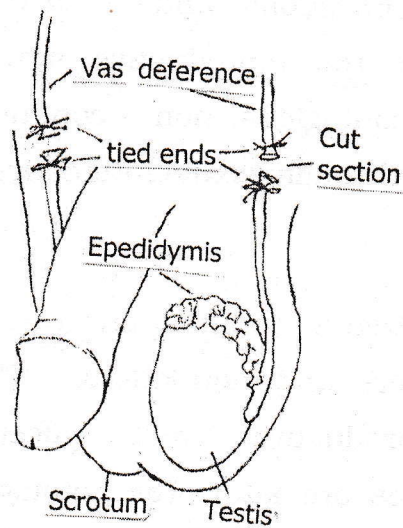
Norplant consists of six flexible rubber tubes, each about the size of a match, that are inserted under the skin in a fan like pattern in the side of the woman's arm. Side effects may include headaches and mood changes.

### **• Sterilization methods**

Sterilization is a procedure in which a male or female is made incapable of reproducing. Sterilization in male is known as vasectomy and in female is called Tubal ligation.

## Vasectomy

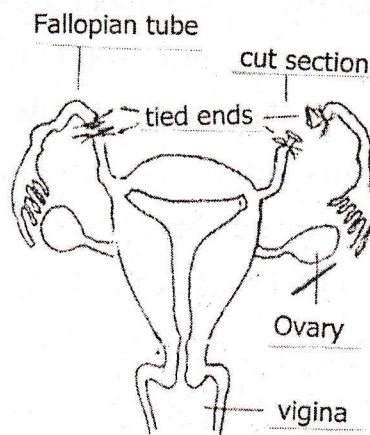
A vasectomy is a surgical procedure in which section of each vas deferens is cut and the ends tied. This procedure prevents sperms from passing from the testes to the urethra.



**Figure 7.1.30: Vasectomy**

## Tubal Ligation

This is a surgical procedure in which the fallopian tubes are cut and the ends tied. This prevents ovum from moving down the fallopian tube after being produced by the ovary.



**Fig. 7.1.31: Tubal Ligation**

Now it is time to see the infections and diseases which affect the reproductive tract.

### **Reproductive Tract Infections RTIs and RTDs Diseases**

Reproductive tract infections and diseases are infections and diseases that affect the reproductive system. These infectious diseases are non - contagious, non - communicable and therefore cannot be contacted through sexual intercourse or contact.

#### **Types of RTI's**

They can be categorized as common and rare ones, sex specific and common to all killers and non-killers. The majority of non - communicable reproductive tract infection which become degenerating diseases are fatal. The common and dangerous are cancers. Cancers are degenerating diseases and cause death.

Examples of RTIs which are common are;

Cancers, fibroids and hydrocoel

#### **Cancer**

Cancer is caused by failure of the mechanism which controls cell division. As a result, cells continue to divide uncontrollably until a mass of cells is produced. This mass of cells is what is known as a malignant tumour. This kind of tumour constitutes cancer. Cancerous cells normally invade and destroy the normal tissue cells. Cancer occurs in an isolated part of the body. Some of its cells may break off from its' original site and enter the blood system or lymphatic system. When this happens, the cancer cells get a chance of invading other tissues of the body producing what we call *metastasis*. When this happens the cancerous cells establish themselves throughout the body. At this stage the cancer becomes fatal and usually ends up in causing death of the person.

## **Types of cancers that affect the reproductive system**

### **Cancer of the cervix and uterus**

Cervical cancer attacks the neck of the uterus or cervix, whereas uterine cancer attacks the uterus itself. Both cancers are dormant for sometime before spreading into other parts of the reproductive system causing much more danger.

#### **Symptoms of these cancers include:**

- Blood stains discharge.
- Vaginal bleeding which is unrelated to menstruation.
- Intense pain in the terminal stage.

### **Cancer of the ovary**

It is less common than cervical and uterine cancers. It is not easy to detect during early stage. As it progresses, a swelling on ovary appears which can be detected by x-ray, if untreated; pain will be experienced in the advanced stages. This may lead into sterility when all ovaries are attacked.

### **Prostate cancer**

This is a common type of cancer which affects men in their fifties and beyond. The prostate gland secretes seminal substances which help sperms to move smoothly during ejaculation. The glands are positioned at the base of the urinary bladder and surround the first part of the urethra.

The exact cause is not yet known although ageing seems to be connected with this condition. Early detection and measurement can save man's life since many cases are fatal.

**Symptoms include:**

- Swelling of the prostate gland.
- Frequent urination with urine coming out slowly.
- In advanced stages, it may cause infertility.

**Testicular cancer**

This is a cancer of testis. It starts as painless swelling on the testis in early stages.

**Fibroids**

These are tumours of the uterus composed partly of muscle tissue and partly of fibrous connective tissues. Fibroids usually do not occur singly. Several fibroids occur at the same time. They may grow to masses weighing one kg. Fibroids are non-malignant. Causes are not known. It may be due to out growth of endometrium layer. Hormones encourage growth of endometrial to nourish embryo foetus. Early menstruation may be the cause.

**Hydrocoele**

Clear watery fluid accumulates in the scrotal sac around the testis and epididymis.

This may develop at any stage. Hydrocoeles are usually caused by some mild irritations in the lining of the scrotal sac. As a result of these irritations, fluid is secreted in the scrotum.

Symptoms of this disease is a painless swelling of the testicles. Hydrocoele swell allows light to pass through when a light is shone on it. Hydrocoeles cause no pain but those which are very large cause annoyance and discomfort and affect self - esteem and

confidence in adolescent boys. Hydrocoeles are most prevalent along the coast where filaria worms exist.

### **Socio - cultural practices and life styles which favour prevalence of RTI'S**

Prevalence of RTI's and STDs are sometimes associated with some socio - cultural practices and life styles which individuals involve in. Some of these practices are as follows:

- Early marriage and early premarital sex, especially in adolescent groups.
- Child preference that leads to a tendency for women to bear many children.
- Induced abortion. Chemicals and substances are used for this purpose because in some cultures children brought forth by extramarital sex are shunned.
- In culture where female circumcision is favoured, wounds of circumcision are responsible for the mild infections, which occur during operation. Such infections may harbour carcinogenic substances, which may later cause cancer of the uterus or cervix.
- Smoking; cigarette smokers take in sufficient carcinogenic substances from nicotine and these circulate in the vascular system and reach the vital parts of the body. These harmful, substances may be responsible for cancer in that part of the body.
- Some cultures do not favour male circumcisions to cut off the prepuce. If not well cleaned regularly, the prepuce tends to accumulate some deposits, which is associated with cancer of the cervix.

## **Ways of minimizing prevalence of RTIs**

- **Education:** The whole society must be educated on cancer and its causes. This knowledge will enable them to take care and seek for treatment early before cancer spreads.
- RTI's can also be minimized by **change in behaviour**. i.e change in habits and life styles that expose us to risk e.g. smoking, early marriages and bearing many children.
- **Regular screening and check up** will reveal signs and hence treatment.
- **Avoid early sex or sex with multiple partners**
- Women and men should **examine themselves regularly** so that they can detect any abnormal changes that occur in their reproductive systems.

Before proceeding further complete the following exercise.

### 7.1.3 SELF CHECK EXERCISE ONE



1. Explain the term reproduction.

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-----

2. Mention two types of reproduction.

-----  
-----

3. Meiosis is.....

4. Write down the significance of meiosis

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-----

5. Explain the following terms:

a) Spermatogenesis-----

b) Oogenesis-----

6. There are two types of twins, namely:

-----  
-----

7. (a).Family planning is-----

(b). List down four ways that are used for family planning.

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-----  
-----  
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Now check your answers against the ones given at the end of this module.

## **Reproduction in Flowering Plants**

We have seen in the previous discussions, how animals reproduce. You now know how and where sperms/ova are produced. You also know their roles in the whole process of formation of a new organism (human).

Let us now work on plants and see how they reproduce. Here you are going to study or learn about reproduction in flowering plants.

- Flowering plants reproduce sexually by means of flowers, and hence they are termed flowering plants.
- The flower is part of the shoot system which becomes modified specifically for reproduction.
- Flowers are reproductive organs found only in flowering plants.

### **There are two types of flowers**

- **Solitary flowers.** These are borne singly e.g. Hibiscus flower, bean flower, pumpkin flowers. Their floral parts are in 4s or 5s or multiple of these numbers.
- **Inflorescence** flowers are when many flowers are borne together on a branch system like capitulum as in a sunflower plant, maize and grass. Floral parts are in 3s or multiples of these numbers.

### **Structure of a solitary flower**

A solitary flower comprises the following floral parts:

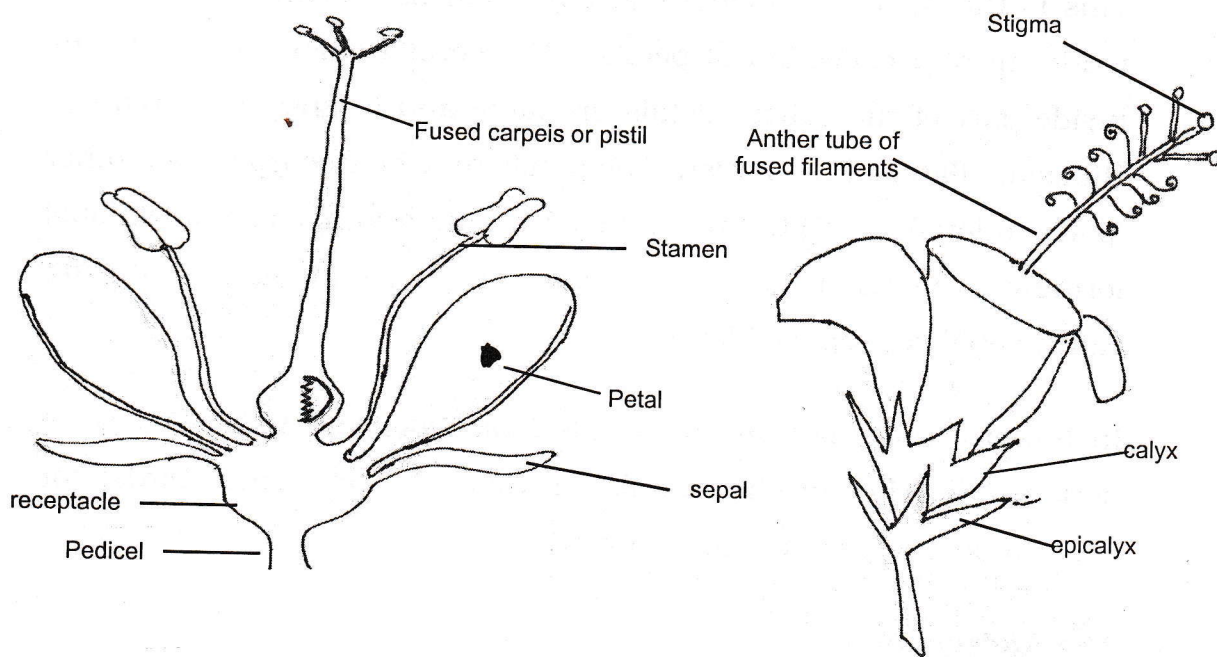
The calyx

The corolla

The androecia

The gynoecium

These floral parts have been arranged in whorls/rings around the receptacle which is the upper part of the flower stalk or pedicel.



**Figure 7.1.32: Structure of flowers**

### **The calyx**

Is the collection of sepals which make the outermost whorl of the floral parts on the receptacle. Sepals are usually small and green. In some flowers, they may be coloured and therefore are called petaloid/petal - like sepals, some petals occur in the form of hairs forming Pappas like in Tridax plant and others as scales as in sunflower. The calyx may be free from each other (polysepalous) or fused together to form a cup - like structure (gamosepalous).

Epicalyx/episepals are green leaf like structures present only in some flowers e.g. Hibiscus. Epicalyx form a whorl outside the calyx.

Both the calyx and epicalyx give support and protect the internal whorls of the flower.

### **The corolla**

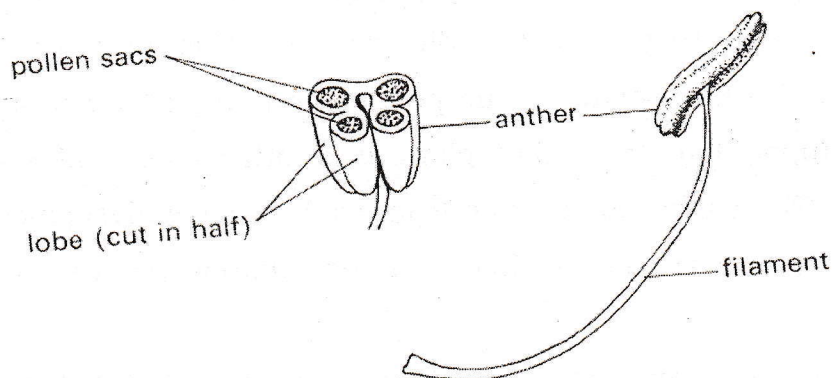
This is the most conspicuous (easily seen) part of the flower. It is made up of a collection of petals. The corolla whorl is next to the inside part of the calyx. Petals are large and brightly coloured e.g. Hibiscus, flame of the forest. The petals may be free from each other (polypetalous) e.g. Hibiscus or fused to one another (gamopetalous) forming a corolla tube. Sometimes the petals are green and are called sepaloid/sepal – like petals.

In flowers where sepals and petals look alike and together form a perianth. The bright corolla attracts insects and birds for pollination and protects the stamens.

### **The Androecium**

This is the male reproductive organ of the flower. It consists of the stamens which lie inside the corolla whorl.

Each stamen consists of an anther (head) and a filament (a long stalk).



**Figure 7.1.33: Androecium**

## **The Gynoecium or Pistil**

Gynoecium is one or collection of carpels forming the female reproductive organs of the flower.

A carpel is made up of an ovary, style and stigma. A gynoecium with a single carpel is called monocarpous and that with two or more carpels is known as polycarpous gynoecium. Fused carpels form syncarpous gynoecium. Free carpels form apocarpous gynoecium. The stigma receives the pollen grains during pollination. The style bears the stigma in a suitable position in the flower to receive the pollen. It is also the path through which the pollen tube carrying the male gametes passes towards the ovary.

## **The Ovary**

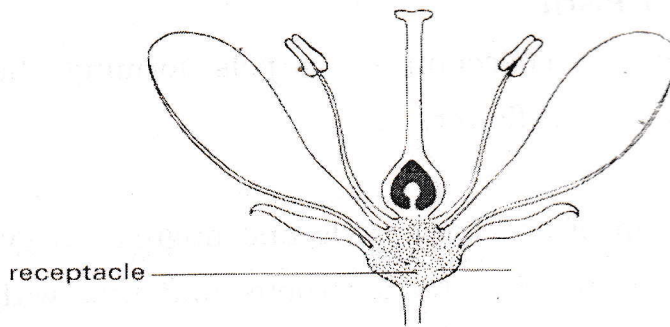
The ovary is the swollen, hollow base of the carpel and contains one or more ovules.

**Ovules:** are the structures which after fertilization become seeds. Each is attached to the ovary wall (placenta) by a short stalk called the funicle.

## **Types of Ovaries**

### **Superior ovary**

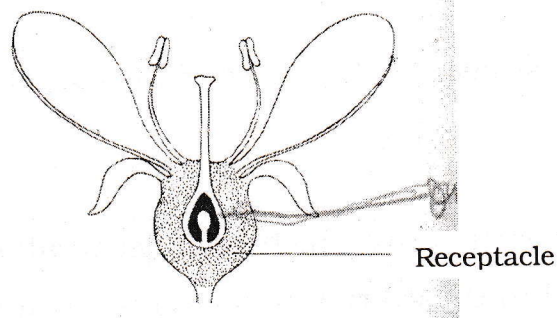
A superior ovary is an ovary located above the other floral whorls (parts) on the receptacle.



**Figure 7.1.34: Position of superior ovary**

### **Inferior ovary**

An inferior ovary is an ovary located below the other floral whorls (parts) on the receptacle.



**Figure 7.1.35: Position of inferior ovary**

### **Nectaries**

These are glandular structures that secrete nectar, a sugary fluid that attracts animals like insects, bats and some birds for pollination.

### **Other terms in describing the flower**

Staminate flowers, a flower with male parts only e.g. maize flowers, pawpaw.

Pistillate, a flower with the female part only e.g. maize, pawpaw.

### **Terms applied to the whole plant**

- Hermaphrodite (bisexual) plants male and female sex organs borne on the same plant e.g. maize and bean.
- Dioecious (unisexual) plants, male and female sex organs borne on separate plants i.e. plants are either male or female e.g. a pawpaw plant.
- Monoecious plants - separate male and female flowers borne on the same plant i.e. hermaphrodite plants e.g. maize plants.

### **Pollination**

We have seen in human that sperms are made in the testis and deposited in the female by the erect penis during copulation. There is no copulation in plants but a process similar to this is used. This process of transmitting mature male gamete to mature stigma is known as pollination.



Pollination is the transfer of mature pollen grains from a mature anther to a mature stigma of a flower.

### **Types of pollination**

There are two types of pollination

#### **Self pollination**

#### **Cross pollination**

#### **Self pollination**

This is the transfer of pollen grains from a mature anther to a mature stigma of the same flower or a flower on the same plant e.g. beans, peas, tomato, cotton. It involves just one plant.

### **Devices which help self – pollination**

- Anthers and stigma of a bisexual flower ripen at the same time (homogamy).
- A bisexual/hermaphrodite flower has both the male and female reproductive organs.
- Anthers hang above the stigma.
- Longer filaments may recoil so that the anthers may come in contact with the stigma.
- Flowers have nectaries.
- Some flowers never open (closed flowers or cleistogamy). Ripe pollen grains are discharged onto the stigma which ripen at the same time.

Insects, bats and birds are agents of self pollinated flowers.

### Advantages of self – pollination:

- Little pollen produced because very little is lost.
- It is almost certain (reliable) to occur in a bisexual flower whose anthers and stigmas ripen at the same time as it does not rely on external factors (wind, insects) to transfer the pollen grains.

### Disadvantages of self – pollination:

- Continue self pollination over several generations results, in weakened. Offsprings, (less vigour) because there will be no genetic variations in the resulting generations (encourages inbreeding) no exchange of genetic material.
- Less chances for a species to survive in a changing environment.

### **Cross pollination**

This is the transfer of pollen from a mature anther of one plant to a mature stigma of another plant. It involves two plants.

### **Devices which favour cross - pollination**

**Dichogamy** - ripening of the anthers and stigma of a bisexual flower at different times. It occurs in two ways.

- **Protandry**, when anthers of a flower ripen earlier than the stigma of that flower or other flowers of the same plant. So, the mature pollen grains are useful only to flowers of other plants which have mature stigmas to receive them (in most plants).
  
- **Protogyny**: When the stigma of a flower matures earlier than its own pollen grains or those of other flowers of the same plant. So, it can only receive pollen grains from flowers of other plants (not common).
  
- **Unisexuality** (unisexual flowers/special floral structures). The female flowers are usually situated higher than the male flowers. So, pollen grains may not reach the stigmas.
  
- **Dioecious** plants where the male and female flowers are borne by different plants.
  
- **Self sterility/self - incompatibility**, is where the pollen grains are sterile in respect to the ovules of the same flower e.g. tea and passion flower. This, favours cross pollination.

### **Agents of cross pollination**

- Insects
- Wind
- Water
- Animals e.g. birds, bats.
- Man.

Advantages:

Increases the amount of genetic variation; it is a form of out breeding

Disadvantages:

- i) The process relies on external agents only e.g. wind, insects
- ii) Much pollen is lost by wind.

**Summary of typical differences between wind – pollinated and insect pollinated flowers**

| Typical wind pollinated flower<br>(Anemophilous flowers)   | Typical insect – pollinated flower<br>(Entomophilous flowers)   |
|--|---|
| Small petals not brightly coloured (usually green) or petals absent hence inconspicuous flowers. | Large coloured petals, conspicuous flowers, if inconspicuous, they may be gathered together in inflorescence. |
| Not scented.   | Scented.  |
| Nectaries absent.  | Nectaries present.  |
| Large branched and feathery stigma hanging outside flower to trap pollen.                        | Small stigma, sticky to hold pollen and enclosed within flower.   |
| Stamens hanging outside the flower to release pollen.  | Stamens enclosed within flower.   |
| Point to tip of filament so that they swing freely in air currents.                              | Point along their backs to the filaments so that they are immovable.  |
| Produce large quantities of pollen due to high wastage   | Less pollen is produced.  |

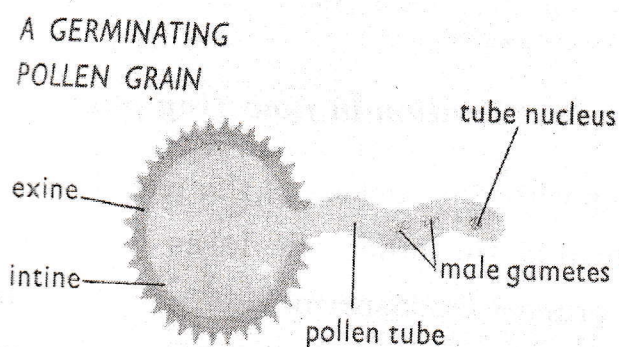
|  |  |
|--|--|
| Pollen grains relatively light and small, dry, often smooth walls. | Pollen grains relatively heavy and large. Spiny walls and stickiness help attachment to insect body. |
| Flower structure relatively simple.                                | Complex structural modifications for particular insects often occur.                                 |

### **Fertilization in flowering plants**

Fertilization as stated earlier in animal reproduction, deals with union of male and female gametes to form an embryo. In plant, fertilization is accompanied with a series of events especially on male gamete (the pollen grain).

In this part, you are going to learn how pollen grains (male gamete) move to the female (an ovule) and the products of their union.

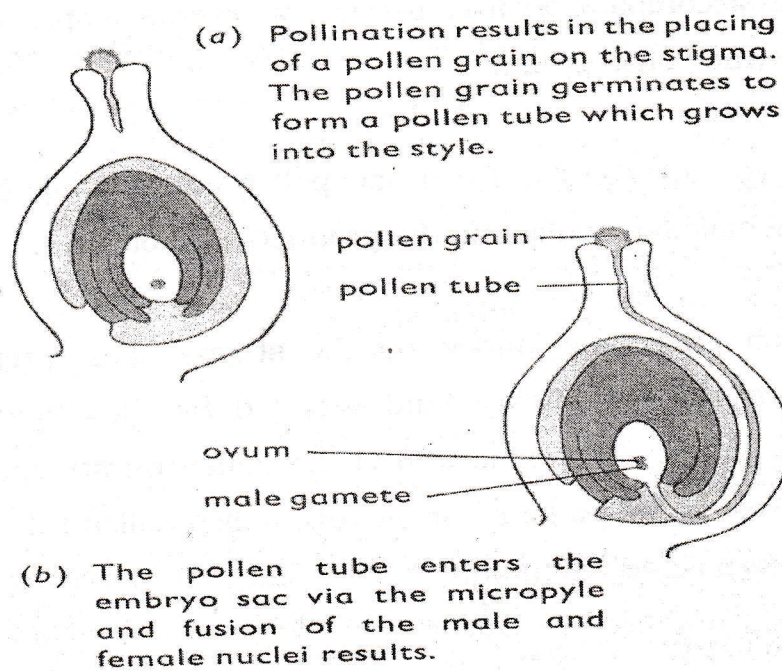
Once a pollen grain has landed on the stigma of a compatible species, it absorbs the sugary fluid secreted by the stigma and increases in volume. The exine wall of the pollen bursts open and the intine grows out into a long narrow tube called pollen tube. This process is known as germination.



**Figure 7.1.36: Pollen grain**

The pollen tube penetrates the stigma and grows down through the tissues of the style. During the growth of the pollen tube, the haploid (n) generative nucleus of the pollen grain divides by mitosis to produce two male nuclei that represent the male gametes. The pollen tube is responsible for conveying these gametes to the embryo sac of the ovary which contain the female gamete.

The pollen tube enters the ovule through the micropyle. The tube nucleus degenerates and tips of the tube burst, releasing the male gametes near the embryo sac, which they enter.



**Figure 7.1.37 Fertilization in flowering plant**

One male nucleus fuses with the nucleus of the female gamete (egg cell) forming a zygote and the other one fuses with the diploid nucleus forming the primary endosperm nucleus. The fusion of the nucleus of the male gamete and that of the female gamete to form a zygote is known as fertilization.

- Flowering plants exhibit double fertilization, a unique feature to flowering plants.

Fusion of the male and female nuclei of their gametes to form zygote.

Fusion of the second male gamete with the definitive/diploid nucleus to form a triploid primary endosperm nucleus. Hence double fertilization.

#### **After fertilization/events following fertilization**

- The zygote grows by mitotic divisions to become a multicellular embryo which consists of the radicle (first root) plumule (first shoot) and either one or two seed leaves called cotyledons.
- The triploid primary endosperm nucleus grows to form the endosperm. (In some seeds, this remains as the food store as in cereals like maize, rice and wheat).
- Some cotyledons may store food *e.g. legumes such as beans, soya.*
- Nucleus break down to supply nutrients for growth in early stages of growth.

Integument layers fuse to form a thin tough protective layer called the seed coat or testa.

- The micropyle remains as a small pore in the testa for gaseous exchange and entry of water when the seed germinates.
- The ovule becomes the seed and ovary, the fruit.
- The remaining flower parts; calyx, corolla, stamens style and stigma, wither and die. Calyx may help to hold the fruit in position.

#### ACTIVITY 7.1.4

1. (a) Visit your surroundings and collect flowers from there.  
(b) With reason(s), classify your flowers basing on the type of pollination.
2. Observe a bee visiting a flower. Can you explain how it facilitates pollination?
3. Find out the reasons why people have gardens of flowers.

#### 7.1.4 SUMMARY OF THE UNIT



- Reproduction can be explained as the ability of organisms to produce new ones of their own kind.
- There are two types of reproduction, namely; asexual reproduction and sexual reproduction.
- Asexual reproduction is the type of reproduction which does not involve gametes. It produces offsprings which are identical to the parents. Paramecium, Euglena, Bacteria are examples of organisms that reproduce asexually.
- Sexual reproduction involves the union of two gametes nuclei i.e. the male gamete and female gamete nuclei. It produces offsprings that are genetically different from their parents and from each other.
- Meiosis is the process of cell division in which the number of chromosomes is reduced to half. It results in the formation of gametes.
- Fertilization is the union between male and female gamete nuclei. In human beings, fertilization occurs in the oviducts (fallopian tubes).
- When a single fertilized egg divides into two cells identical twins are formed. Those twins have the same characteristics and sex.
- When two eggs are released at the same time from either one or both ovaries and fertilized by different sperms, fraternal twins are formed. These twins are different in characteristics and may be of the same or different sex.

*Before proceeding further complete the following exercise.*

**7.1.5 SELF CHECK EXERCISE TWO**



1. What is a flower?

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-----

2. State the main external components of a solitary flower.

-----  
-----

3. Give the names of reproductive structures in both the androecium and gynoecium.

-----  
-----

4. Distinguish between pollination and fertilization.

-----  
-----

5. What happens to the ovule and ovary following fertilization?

-----  
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*Compare your answers with those given at the end of this unit.*

### 7.1.6 TUTOR MARKED ASSIGNMENT



Now answer the following questions in the workbook provided and send to your Tutor for marking and commenting.

1.
  - (a) Explain the meaning of reproduction.
  - (b) List and differentiate two types of reproduction
  - (c) What are the advantages and disadvantages of each types of reproduction?

**(20 Marks)**
  
2.
  - (a) What are similarities between mitosis and meiosis?
  - (b) Tabulate at least four differences between mitosis and meiosis.

**(20 Marks)**
  
3. At what phase of meiosis do the following events happen?
  - (a) Pairing of homologous chromosomes
  - (b) Crossing over to form chiasmata
  - (c) Bivalents are arranged around the equatorial plane
  - (d) Homologous chromosomes move towards the opposite poles.
  - (e) Four new cells are formed.

**(5 Marks)**
  
4. Draw and label the diagram of
  - (a) Male reproductive organs
  - (b) Female reproductive organs

**(20 Marks)**
  
5. Differentiate between these pairs
  - (a) Penis and clitoris
  - (b) Urethra and vas deferens
  - (c) Style and filament
  - (d) Family planning and child spacing.

**(20 Marks)**
  
6. If you are/were a parent and you want to have practice planning. Which method will/would you use and why?

**(5 Marks)**
  
7. Explain why life on earth never perish despite the fact that organisms die everyday.

**(10 Marks)**

## 7.1.7 KEY ANSWERS TO SELF CHECK EXERCISES

### Exercise One



Reproduction is the process by which living organisms produce new ones of their own kind.

1. (i) Asexual reproduction  
(ii) Sexual reproduction
  
2. Meiosis is a form of nuclear division in which the chromosomes number is halved from the diploid number ( $2n$ ) to haploid number ( $n$ ).
  
4. (i) Cause formation of sex cells for reproduction  
(ii) Maintains diploid number ( $2n$ ) of chromosomes in successful generations.  
(iii) Brings about genetic variation in the offspring produced by the fusion of gametes.
  
5. (a) Spermatogenesis is the formation of male gametes (sperms)  
(b) Oogenesis is the formation of an ovum (female gamete)
  
6. - Identical twins  
- Fraternal (non – identical) twins
  
7. (a) Family planning is an individual's ability to decide freely how many children he/she may want to have, when he/she wants to stop having them.  
(b) - Natural methods e.g. calendar and billing methods.  
- Barrier method e.g. using condoms and IUCDs  
- Hormonal methods e.g. oral contraceptives.  
- Sterilization methods e.g. vasectomy and tubal ligation

## Exercise Two

1. A flower is a modified part of stem in which the primary sex organs are found.
2. Pedicel, receptacle, sepals, petals, stamen, filament style and stigma.
3. The androecium is the male reproductive organ of the flower. It consists of stamen which *includes filaments and anthers*.  
- Gynoecium is one or collection of carpels forming the female reproductive organs of the flower. A carpel is made up of an ovary, style and stigma.
4. Pollination is the transfer of pollen grains from an anther to the stigma. Fertilization is the union of male gamete and female gamete to form a zygote.
5. The ovule becomes a seed.  
The ovary may develop into a fruit.

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