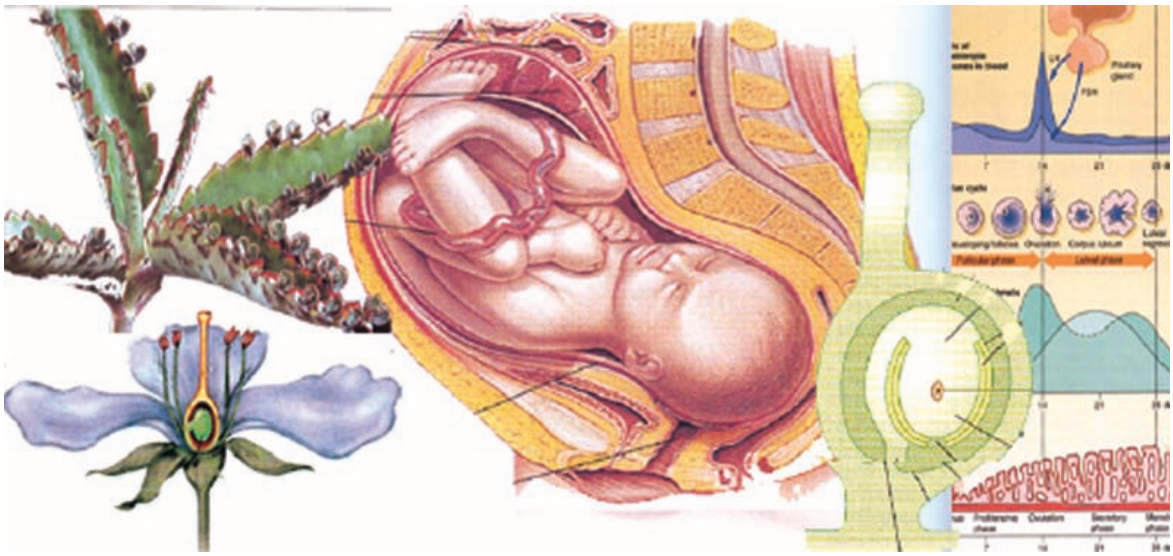
2. Reproduction in Organisms



At the end of this Chapter, you will be competent to:

- Investigate how the natural and artificial vegetative methods are applied scientifically for the propagation of plants.
- Investigate how sexual reproductive methods are applied scientifically.
- Investigate the importance of reproduction for the survival of man.
- Investigate the contribution of sexual and vegetative methods of reproduction for the survival of organisms.

2.0 Reproduction

If we look closely at the living world around us, we see that all plants and animals pass through definite stages in life from birth to death. A plant that starts life from the seed passes through a number of stages before becoming a mature plant.

Considering man, he too passes through many stages such as infant, childhood, youth, middle age and old age. All of them eventually die at some stage. If all those who are born die without producing a new generation, how does the life go on? If all organisms of a particular species complete their full life span and finally die, that species will come to an end. Therefore, for the continuity of a species, the existing generation should produce another generation before their death. The production of a new organism by the existing organism is called reproduction. Reproduction is common to all of the living world. This ensures the continuity of life.

Reproduction in plants

There are two main methods by which plants reproduce. They are

- Asexual reproduction
- Sexual reproduction

Flower is the organ specialized for sexual reproduction.

Asexual reproduction can be of several types, but here we will consider only the vegetative propagation methods of plants.

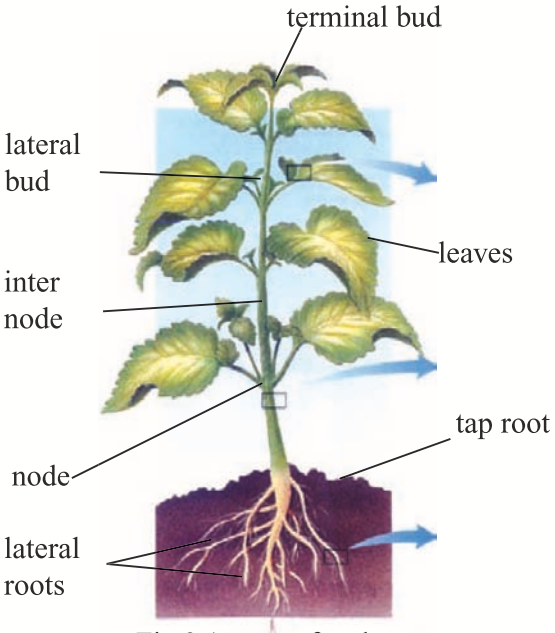


Fig.2.1 parts of a plant

2.1 Vegetative propagation in plants

In vegetative propagation, a vegetative part of an existing plant itself is detached and grown into a new self- supporting plant.

Vegetative propagation methods can be divided as follows;

- Natural vegetative propagation methods
- Artificial vegetative propagation methods

Natural methods of vegetative propagation in plants

Natural vegetative reproduction is getting new plants from parts such as roots, stem , leaves or any vegetative part of the plant. Often vegetative reproduction involves some sort of storage organs which lie under the soil for some time and when conditions are suitable, it may develop into one or more plants. Storage can take place in the stem, roots, leaves or even buds. Therefore, these parts can be used to generate new plants.

Propagation by stems

i) Underground stems

Stems are usually found above the ground but in certain plants they may be below the ground. Observe some underground stems of Ginger or Turmeric carefully. All the parts of an aerial stem can be seen here too. The horizontal lines represent the nodes and the brown scales represent the leaves. The axial nodes and atillary buds can be recognised easily. These underground stems store food material and therefore even after an unfavourable condition at which all the above ground parts die, these plants will be able to survive. They sprout from their underground stems. According to the external features, underground stems can be divided into 4 main types, namely rhizomes, corms, stem tubers and bulbs.

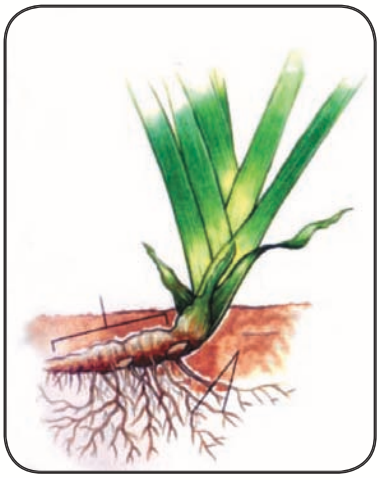


Fig.2.2 Rhizome

Rhizomes

Stems that grow horizontally under the soil are the rhizomes. They are enlarged due to the stored food in them. Nodes, internodes and scale leaves can be recognized easily. The axial nodes at the axes of the scale leaves give rise to new plants. e.g. Ginger, Turmeric Canna

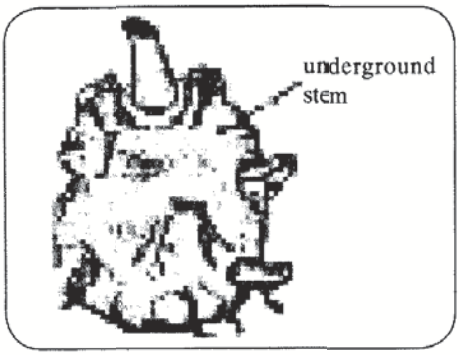


Fig. 2.3 Corm of Colacasia

Corms

These stems grow vertically under the soil. As a new part of the stem grows, the old part gets pushed down. Fibrous roots may be seen at the base or sides of the corm.
e.g. *Colocasia, Alocasia, Gladiolus*

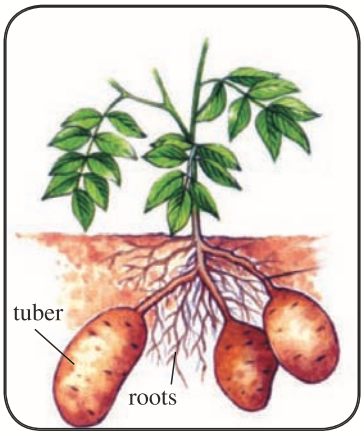


Fig.2.4 Tuber of potato

Stem tubers

The underground stem branches under the soil. The ends of these branches store food and swell up forming the tubers. If you examine a tuber of potato you can recognize the 'eyes' from where the new plants sprout up. e.g. Potato

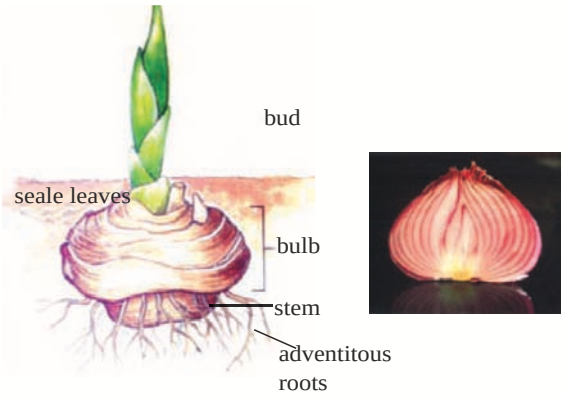


Fig. 2.5 Bulb of onion

Bulbs

In onion the true stem is flat. Fibrous roots come out from it. The leaf bases which come up from the stem store food and are thick. These lie on one another giving it a shape of a bulb. E.g. Onion, leeks.

ii) Stems above the ground

Apart from underground stems, stems that grow along the ground too can produce new plants. Some examples are given below:

Fig. 2.6 Runner of centella

Runners

These are side shoots that grow over the soil. These are attached to the ground by roots at the nodes from where a new plant would grow. If we try to pull out one of the new plants the entire plant will come off. e.g. Gotukola, Strawberry *Spinifex*

Fig. 2.7 Karapincha
(Curru leaves Plant)

Reproduction by roots

Roots too can give rise to new plants. Ground underneath a 'Karapincha' or bread fruit tree has many new plants which come up from the roots. These can become independent plants. e.g. Bread fruit, Karapincha (Curry leaf plant).

Fig. 2.8 Leaf of bryophyllum

Reproduction by leaves

Certain leaves too have the ability to produce new plants. Leaves of *Bryophyllum* produce new plants at the edges of the leaf. (Fig 2.8) Begonia leaves also can produce independent plants.

Fig. 2.9 Bubil of pinapple

Reproduction by buds

Bulbil

In some plants, aerial buds can modify into structures that can grow into new plants. They are called bulbils. The part above the fruit in pineapple can be used to get a new plant. e.g. Pineapple hemp.

Advantages of vegetative propagation

- To propagate plants which either do not produce seeds or produce few seeds.
- To maintain the heridity of high quality characters of plants, by cloning.
- To identify the varieties that are resistant to pests and diseases and to propagate them
- To propagate varieties that can withstand drought and or any unfavourable environments. The disadvantage of the vegetative propagation method is that the inability to produce new varietires.

Activity 2.1
Collect the following: Potato, turmeric, raddish, ginger, beet, 'inala', and onions. Underground roots from stems using basic features and make lists of plants.

Artificial methods of vegetative propagation

In these methods which were devised by man, a part of the mother plant in taken and raised into new plants. Benefits of such methods are;

- Obtain new plants from seedless varieties
- To Propagate plants with features useful to man.
- Getting a bigger harvest
- Getting a large number of new plants in a short time
- To obtain many plants of new improved varieties efficiently.

The ability of plants to grow vegetatively is made use in artificial vegetative propagation. Various methods can be used for this.

- **Cutting**

Part of a stem, root or a leaf is cut and allowed to grow as an individual plant. At present, hormones are used to speed up the rooting process. Stem cuttings are used in roses, hibiscus, temple-trees, manioc, tea etc.
Begonia leaf can be made to produce new plants by making cuts on the leaf veins and putting it in a special rooting media. New plants would grow from the cuts.

- **Layering**

In this method, new plants are made to root while still attached to the mother plant. There are two methods commonly used.
Ground layering - Jasmine, lemon are propagated in this manner.
Aerial layering - Twigs above the ground are made to root by tying a lump of soil around the aerial part. When rooted, this part is removed from the mother plant and grown as an individual plant.Ornamental plants such as croton, ixora and some fruit plants are propagated in this manner.

- **Grafting**

Have you ever wondered how many grafted plants are there in your garden? Grafted ‘rambutan’, mango, amberella and oranges are very common in our home gardens. In

grafting, a bud or a twig from one plant is fixed to another plant of the same species and allow to grow as a single plant. In grafting, the plant fixed to the soil is called the **stock** and the part that is joined is called the **scion**. To obtain successful results, we should be very particular about the stock and the scion we select. The two plants should be of the same family. Some important features considered when selecting the stock and the scion are:

Stock	Scion
• Should have a strong healthy root system	• Should be of high quality e.g. Sweet fruits, colourful flowers
• Resistsnt to diseases and changing environmental conditions	• Should be free of pests and diseases
• Should show even growth	

Grafting can be of two types; **Bud grafting** and **twig grafting** are these two main ways.

Bud grafting

Here a piece of bark with one bud from the selected scion is fixed to the selected stock. According to the way the grafting is done, bud grafting is named as H-budding, T-budding, V-budding or patch budding.

Twig grafting

Here, a twig from a plant is selected as the scion. It is grafted to a stock of the same species. The lower end of the scion is fixed to the upper end of stock. Conditions needed for a successful graft are: Close affinity between scion and stock and cambium of both stock and scion should contact each other.

Advantages of graffing

- Daughter plant will obtain the characteritics similar to the scion.
- The plant will have a better. strong root system.
- Obtain new plants from seedless varieties,
- To propagate varieties resistant to diseases in an efficient way.

Activity 2.2

Try to do a bud graft or a wedge graft on a plant such as rose or hibiscus using a sharp knife instead of a special budding knife.

Observe the nature of the graft at the end of two weeks.

Tissue culture and cell culture (Micro propagation)

In tissue culture, plant or animal tissue is made to grow in a sterillized medium (culture medium) to obtain new plants or animals. In cell culture, very often a cell is used instead of a tissue. This method is used specially in animal breeding. For various purposes, human cells too are cultured using cell culture technology.

Tissue culture is been used for the propagation of ornamental plants like orchid and fruit plants like banana. etc. Tissue culture medium is often solid or semi-solid. It contains sucrose, minerals, vitamins, and growth hormones. Agar is used as the gel.

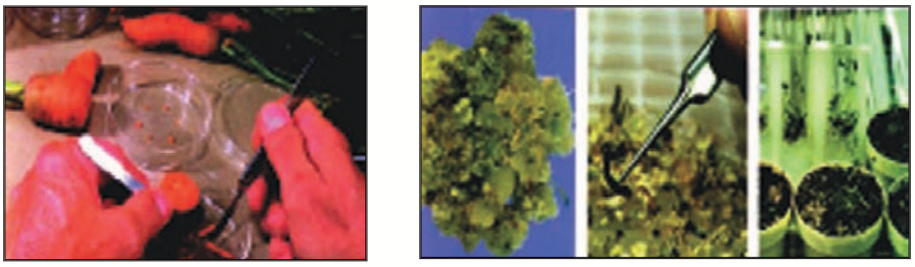


Fig. 2.10 Different stages of tissue culture

Activity 2.3

Find out about the advantages and disadvantages of tissue culture from books or from tissue culture centres, and prepare a report.

2.2 Sexual reproduction in plants

Sexual reproduction is common to all flowering plants. The organ of the plant specially adapted for this purpose is the flower. The main function of the flower is to produce the reproductive cells or gametes which are the important cells in sexual reproduction.

Parts of the flower

Fig. 2.11 External view of a flower

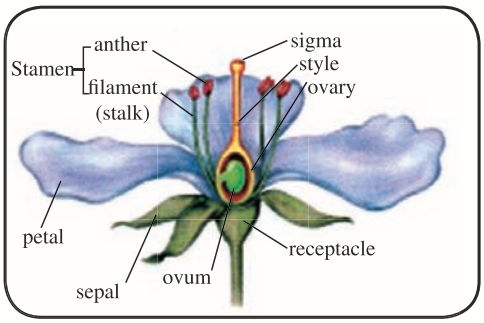


Fig.2.12 L.S of the flower

A flower is made up of sepals on the outside, large coloured petals inner to it, and the androecium and gynoecium inner to the petals. Androecium is made up of the stamen consisting of the anther which has the pollen sacs, and the filament

It is the male sex organ of the plant. The gynoecium or carpel is the female sex organ of the plant, made up of the ovary, style and stigma. Ovary contains ovules which may be observed under the microscope.

Activity 2.4

Take a hibiscus flower and cut off its stalk. Split the flower carefully into two longitudinal halves with a sharp knife. Separate the two halves. Identify the parts of the flower. Make a labeled drawing of the half. Write out the function of each part.

Activity 2.5

Take a Hibiscus flower. Cut a cross section of the ovary (situated slightly above the stalk). Use a magnifying lens and identify the ovules, how they are connected each other and with the ovary wall. Make a labeled drawing.

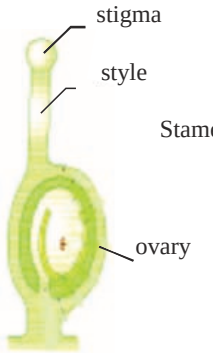


Fig. 2.13 Gynoecium

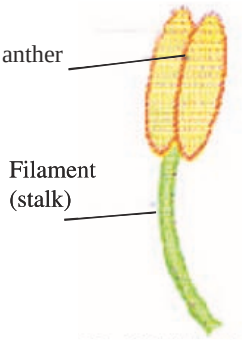


Fig. 2.14 Androecium

The flower you observed had both the androecium and gynoecium on the same flower. Such flowers having both parts are bi-sexual flowers. In certain other flowers, they can be in separate flowers also. Such flowers are uni-sexual flowers. The plants carrying both male and female flowers in the same plant are called monoecious plants.(e.g. Coconut, Karawila, Mormodica)

When male and female flowers are found in different plants, they are called dioecious plants.

Activity 2.6

Collect a number of different kinds of flowers. Observe the androecium and the gynoecium of each with the help of a hand lens. Make labeled drawings of each. Identify the diversity among flowers.

Pollination

A new seed begins when the male sex cell in a pollen grain, joins up with the female sex cell in an ovule. The first step of this process is **pollination**. Pollination takes place when pollen produced by the anther, is deposited on the stigma of the same flower or in a different flower belong to the same species. According to the manner in which pollination takes place, there are two ways, namely;

Self pollination - Mature pollen of one flower is deposited on the stigma of the same flower.

Cross pollination - Mature pollen from one flower is deposited on the stigma of a flower from a different plant of the same species.

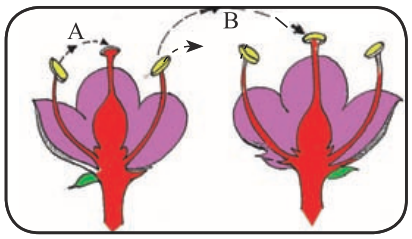


Fig. 2.15 Self pollination (A) & Cross pollination (B)

Fig. 2.16 Cross pollination

In cross pollination, since the ovum of one plant get fertilized by pollen of another plant, new characters may be seen in the new plant. Therefore, plants show various adaptations to promote cross pollination and avoid self pollination.

Adaptations of plants for cross pollination and to avoid self pollination

- Having uni-sexual flowers (male flowers or female flowers) e.g. Coconut, nut-meg, Pumpkin, Corn, Palmyrah, Papaw.
- Having the androecium and gynoecium maturing at different times. e.g.Tridax
- Having the stamens and the stigma away from each other. e.g. Orchid, *Vinca rosea.*
- Having the stamens and stigma at two different levels. e.g. Idda flowers
- Self sterility - Stigma being sterile to pollen from the same flower. e.g.Passion flower.
- Having stamens turning outwards away from the stigma.eg.*Gloriosa*(niyagala)

Some plants cannot be so easily differentiated as self pollinated or cross pollinated. In nature both methods may occur, that is when cross pollination fails flowers may resort to self pollination.

Activity 2.7

By dissections xua of different flowers, identify methods used for preventing self pollination.

Fig. 2.17 Ways of preventing self-pollination

Pollinating agents

If cross pollination is preferred by plants , the pollen needs to be transferred from one flower to another. How is this done? It is by using **air, water** and **animals,** which are the factors that are in close contact with flowers. These factors are called pollinating agents.

Fig. 2.18 Insect -pollinated flowers

Pollination by animals

These can be easily identified by the large, beautifully coloured petals, and the possession of nectar. Animals which are attracted to these help to pollinate the flower. The biggest contribution for cross pollination is from insects.

Fig. 2.18 Wind pollinated flower

Pollination by wind

These flowers are usually uni-sexual with male and female flowers on separate plants. Male flowers are placed high up on the tree and have very light pollen. The stigma of the female flowers are featherlike Most grasses are wind pollinated. (Fig. 2.19)

Pollination by water

You are familiar with submerged plants in a fish tank.The male and female flowers are separate and when the pollen are ripe, the male flower breaks off from the plant and floats on water. When it approaches the stigma of a female flower, pollination takes place. e.g. *Valisnaria* (Fig. 2.20)

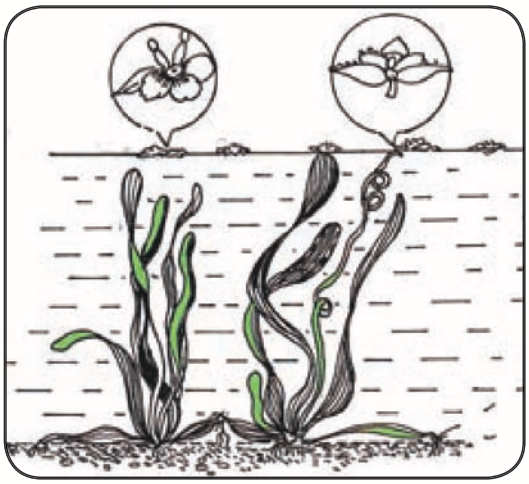


Fig.2.20 Water pollinated flower

Assignment 1

Observe carefully a grass flower and a hibiscus flower. Compare the sepals, petals, androecium and gynaecium of the two flowers. Based on your observations write down the differences between wind pollinated flowers and insect pollinated flowers.

Artificial pollination

Depositing pollen of one flower on the stigma of another flower of the same species by artificial means is called artificial pollination.

Activity 2.8

Select an anthurium flower or a passion fruit flower, and try to pollinate it with the help of your teacher.

Do you know?

Water lily, Lotus and Nymphea are plants that grow in water, yet their flowers are not pollinated by water as the flowers are positioned above the water level. Thus they are pollinated by animals.

Have you observed the changes in the flower after pollination by any of the methods stated above? Note the parts of a mature ovary by examining a longitudinal section through the gynoecium. (Fig. 2.21) Similarly a mature pollen grain will have the structure shown in Fig. 2.22 when observed under the microscope. Its outer wall is sticky and has pointed processes.

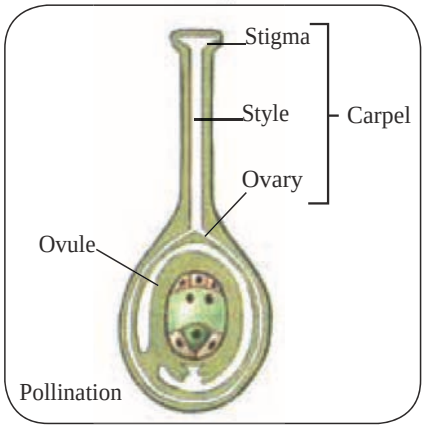


Fig. 2.21 Longitudinal section and gynoecium

Fig. 2.22 Mature pollen grains (Enlarge)

Fertilization

Inside a pollen grain, there is a generative nucleus and a tube nucleus. Stimulated by a sugary solution from the androecium, the pollen grain begins to grow. Through a thin part of the wall, the cytoplasm of the pollen grain grows out as a tube. This is known as pollen tube. The generative nucleus (male sex cell) moves down through this tube towards the ovum.(Fig. 2.23)

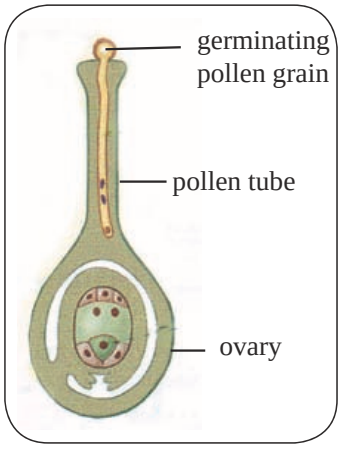


Fig 2.23 Growth of pollen tube

Activity 2.9

Prepare a solution of sugar with half teaspoon of sugar in 10ml of water. Select some mature pollen grains from a selected plant and place them in this solution. Observe after half an hour under the microscope.

The tip of the pollen tube ruptures and the male nucleus (generative cell) fuses with the female nucleus in the ovule. This is called fertilization. After fertilization the ovary undergoes a number of changes. The sepals and petals wither off. Ovary becomes a fruit , and ovules become seeds. The wall of the ovary becomes the wall of the fruit and the wall of the ovules becomes the wall of the seeds.

The ovules which do not get fertilized do not become seeds. The sterile seeds inside a fruit are such ovules. Now, flowers with such unfertilized ovules are made to become fruits by the use of hormones. This method of getting fruits is called **parthenocarpy.** Seedless varieties of oranges and grapes are result of parthenocarpy.

Fruit and seed dispersal

Dispersal is the scattering of fruits and seeds far away from the parent plant. Dispersal helps the plant in many ways, such as;

- Reducing competition
- Seeking new habitats
- Avoiding pests and plant pathogens.
- to increase the diversity of species.

Agents for dispersal

Fruits and seeds are dispersed by wind, water, animals as well as by explosive mechanisms.

Fig 2.24 seeds dispersed by water

Seeds dispersed by water -
Adaptations of these seeds are;

They are light, impervious to water, and do not germinate till the pericarp decays. eg. Coconut, Kottamba, Lotus,

Has a keel like structure which helps it to float acting like an oar. e.g Heritera.

Has arillus filled with air to make it float. e.g Water Lily.

Fig. 2.25 seeds having a tuft of hairs

Seeds dispersed by wind -
Adaptations of these seeds are;

Bearing featherlike structures
e.g. ***Dipterocarpus,*** (Hora) ***pterocarpus,*** (Gammalu) ***Moringa,*** (Murunga) sal.
Having a tuff of hairs
e.g. Vara, Clematis,
Having fine fibres on the seed
e.g. Cotton
Having extremely light seeds
e.g. Orchid

Seeds dispersed by animals - Adaptations of these seeds are:

Having sharp hooks, spines, hairs for clinging onto animals e.g (Fig. 2.26 b) Epala *(urena)*, Thuththiri *(chrysopogon)*, pita sudu pala (*boeharvia)*
Having the shape of a beetle which will deceive birds to take it away. It will be dropped at a new place. e.g. Olinda. Castor, madatiya.
Having. fleshy, tasty edible fruit or seed coats. e.g. Mango, Rambutan (Fig. 2. 26a)

Fig.2.26 (a) fleshy fruits

Fig.2.26 (b) having spines

(a) (b)

Fig.2.27 Beans

Seeds dispersed by explosive mechanisms
Adaptations of these seeds are:

Having a fruit which explodes forcing out the seeds inside them.
e.g. Rubber, Balsam, Beans
Exploding is due to touch, moisture, or drying. (Fig. 2.27)

Activity 2.10
Collect seeds and fruits from your school garden. From their features sort them under the four ways of dispersal.

Germination of seeds

Germination is the emergence of the young plant or embryo, by the rupture of the seed coat due to the active growth of the embryo inside. Factors affecting germination of seeds can be grouped under two groups.

Internal factors - Viability (the ability to germinate)

External factors - Water, air (oxygen), and suitable temperature.

Activity 2.11
Plan out a suitable experiment to find out the factors needed for germination of seeds.

In germination, the embryo developes into a seedling. There are two ways in which this happens.

Hypogeal germination

Here the seed germinates and the coleoptile comes above the ground, but the seed leaves remain underground. The seed leaves provide food for the young plant but it does not prepare food as they are underground.(Fig. 2.28). e.g. Coconut, corn

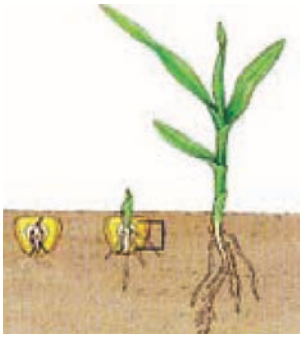


Fig. 2.28 -Hypogeal germination

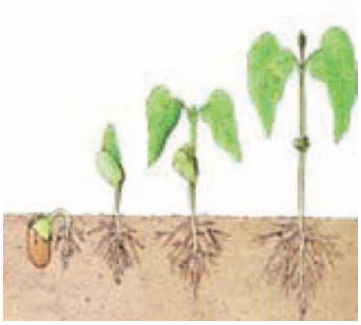


Fig 2.29 Epigeal germination.

Epigeal germination

Here the seed germinates, the coleoptile comes above the ground. The seed leaves too come above the ground. Initially they provide the seedling with stored food, but later they turn green and prepare food for the new plant (Fig. 2.29). e.g. Beans, Tamarind,chilli

In the presence of all these above factors, some seeds may not germinate. This phenomenon is called **dormancy of seeds**. It could happen if the embryo is not properly matured or when the seed coat is impermeable to water and air.

2.3 Human reproduction

Human beings are uni-sexual, that is males and females are sexually different. Externally, the two sexes can be easily identified. This is known an **sexual dimorphism.**

In childhood,there is no difference between the two sexes other than sexual organs. There are two specialized systems for the purpose of reproduction in the two sexes, namely the **female reproductive system** and the **male reproductive system.** These two systems are built up on a common basic plan, that is the organs for producing the gametes and a system of ducts to transport the gametes.

As mentioned earlier, in the early stages,there are no external differences between the two sexes, except the basic differences. But with adolescence, around 10-14 years (at puberty) certain changes can be seen.The external changes that appear with adolescence are called **secondary sexual characters.** Particularly the changes in the body shape,appearance of hair at certain places of the body are some of these changes.

Development of secondary sexual characteristics is associated with sexual maturity, but it also depends on certain external factors such as health, nutrition, environment sexuality etc. Hence, a definite age cannot be specified for an individual, yet it is around 10-14 years of age.

With adolescence in males, body becomes stronger and more muscular, voice deepens, shoulders get wider. skin becomes coarse, hair develop in the chest, armpits and in the pubic region. Facial hair forms the beard.

The changes in females, with adolescence are totally different. Breasts develop with the development of mammary glands. Hips get broader, and the body gets more rounded due to the deposition of fatty tissue under the skin. Skin becomes softer and development of hair is limited to arm pits and pubic region. As in boys, there is no change in the voice. They become more serene.

In addition to these physical changes, certain mental, social and emotional changes too take place in both sexes.

Assignment 3

You are in the adolescent stage. As such, you are creative, active and can think logically. Discuss with your peers what potentials or skills you prossess at this stage of you life.

Let us consider the structures of the male and female reproductive systems.

Male reproductive system

Male reproductive system is composed of the following parts:

two **testes**

two **epididymis**

two **deferent ducts (vas deferens)**

two **spermatic cords**

two **seminal vesicles**

two **ejaculatory ducts**

one **prostate gland**

one **penis**

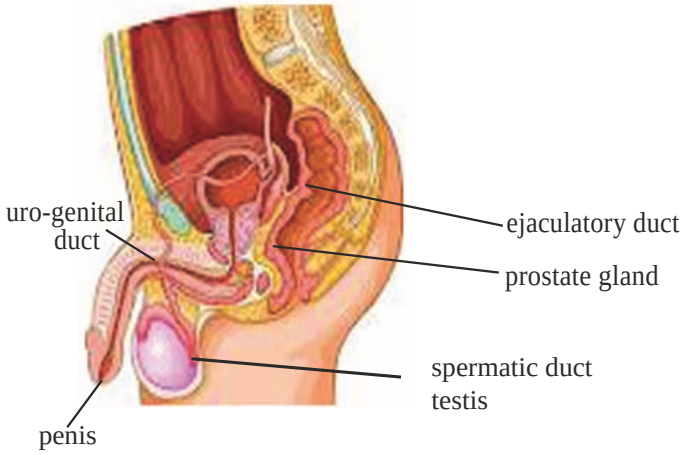


Fig.2. 30 Male reproductive system and associated structures

Males have a pair of testis which inside a pouch called the scrotum which is outside the body. Sperms, are produced in the testes. This process is called spermatogenesis. Testis is made up of a number of convoluted tubes called the **seminiferous** tubules. Each testis has about 1000 such tubules. The tubules are in clusters. Each cluster opens into a single , highly coiled part which is called the epididymis just above the testis. Epididymis opens into the vas deferens and leaves the testis as the spermatic cord. The spermatic cord runs straight upwards and posterior to the bladder receives ducts from the seminal

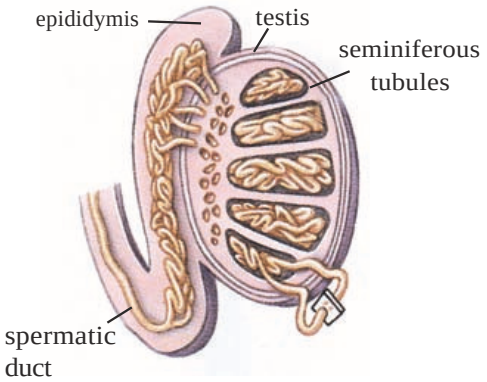


Fig. 2.31 Longitudinal section of the testes

vesicles. From here onwards it is called the ejaculatory duct which joins with urinary duct from the bladder to form the urethra or the urino-genital duct. It opens to the exterior by the penis. Penis is a special organ confined to the male reproductive system and is also used for introducing sperms into the female reproductive system. In males, the urethra is a common duct to both urinary system and the reproductive system.

Functions of the male reproductive system

The male gamete is the sperm. Production of sperms begin with adolescence in man. Sperms are formed by the walls of the seminiferous tubules and as they mature get pushed to the centre of the tubule. Spermatogenesis is sensitive to temperature. It occurs at a temperature slightly lower than body temperature. If the temperature is high development of sperms can be inhibited or may form abnormal sperms. Therefore, testis are found outside the abdominal region.

Mature sperms are motile. It consists of three parts, the head, body and tail.


Fig 2.32 Human sperms

Do you know?

One ml. of semen contains about 120 million of sperms. If this number goes down below 40 million, a man's fertility may be affected.

Sperms formed in the testis are temporarily stored in the epidydimis. Sperms need a liquid medium for transport. This is provided by secretions poured into the urinary duct. A pair of seminal vesicles, prostste gland and the Cooper's gland secrete fluids which together with the sperms to form semen. Semen is a whitish liquid. This fluid not only provide a medium for transport but also helps to nourish and keep the sperms alive. The sperms which were temporaily stored in the testis is get ejaculated through the urenogenetal duct.

Female reproductive system

The female reproductive system is composed of the following parts:

two ovaries
two oviducts (Fallopian tubes)
one uterus
one vagina and external genotalia.

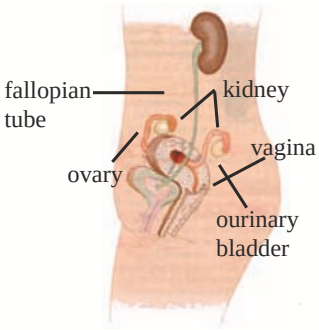


Fig2.33.Female reproductive system

A pair of ovaries are placed inside the abdominal cavity. They are small structures near the lateral walls of the pelvis. Ova (female sex cells) are produced in special structures called Graafian follicles. The thin short fallopian tubes become funnel shaped near the uterine end. The free end of the fallopian tube has finger like projections which help to attract the mature ova into the tube. The uterus is a hollow, muscular, pear shaped organ. At it's lower end is the cervix. The cervix separates the uterus from the vagina. The vagina opens to the outside while the urinary tract opens by a separate opening.

Functions of the female reproductive system

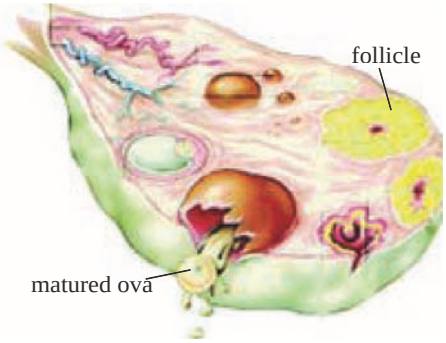


Fig 2.34 Section of ovary just before ovulation.

In females the formation of ova begins even before birth, that is in the foetal stage. At birth, each ovary has about 200 000 - 400 000 follicles but of these only about 300 - 400 are matured. Before puberty the ovaries are inactive but after puberty ova begin to mature. When an ovum is mature and about to be released, the follicle moves to the periphery of the ovary. The follicle will rupture and release the ovum into the peritoneal cavity during each menstrual cycle. This is called ovulation.

Do you know?

A girl after puberty willl continue to ovulate up to the age of about 45 - 50 years after which ovulation stops. But in males spermatogenesis does not stop with age. From an age of about 13 - 14 production of sperms take place till death.

Normally, ovulation takes place every 28 days and alternatively in the right and left ovaries each month, hence it is a cyclic process.

The ova which are released to the body cavity get drawn to the fallopian tube by the activity of the hairs in the funnel shaped end. The ova are carried to the uterus along the fallopian tube. A female has only one uterus (womb). If a child is conceived the uterus enlarges. The uterus does a very important function. It protects and nourishes the growing embryo till the birth of the child.

Fertilization

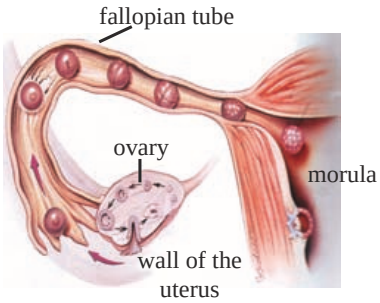


Fig. 2.35 Path of the fertilized ovum along the fallopian tube

The sperms released into the vagina swin in the fluid medium in it and reach the upper part of the fallopian tube. The ovum that is released to the fallopian tube meets the sperms and will fuse with one of them swimming up. Fusion of an ovum with a sperm is fertilization. Fertilization often takes place at the upper end of the fallopian tube.

The fertilized ovum is called the **zygote**. As it goes down the tube, it starts to divide. At the time the zygote enters the uterus it is already a microscopic ball of a few hundred cells. Here, it gets embedded in the thick lining of the uterine wall. This is called **implantation**.

Do you know?

The fertilized ovum takes about 5-6 days to travel along the fallopian tube and get to the uterus. At this stage, the fertilized ovum is known as 'morula'

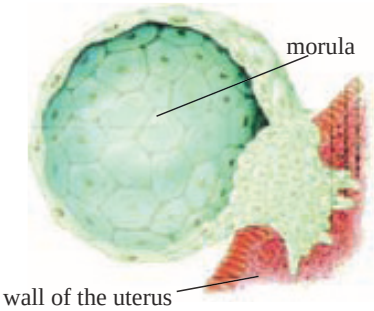


Fig. 2.36 Implantation of foetus

After implantation, more division takes place and the embryo develops further. Around the 6th week, the embryonic membranes begin to develop. It is now known as the **foetus**. It is enclosed in a fluid filled bag or foetal membranes. Foetus is embedded in this fluid. The place where the foetus is connected to the uterine wall is a special structure called the **umbilical cord**. Nutritive materials and oxygen from the mother pass into the foetus while carbon dioxide and waste materials from the foetus pass into the mother's blood through the umbilical cord.


Fig. 2.37 Foetal membranes


Fig. 2.38 The placenta

Due to this, close connection develops between the maternal blood and the foetal blood. There may be certain harmful effects too. Certain drugs taken during pregnancy can affect the growing foetus. Also certain infections such as German measles may have harmful effects on the foetus.

Development of the foetus

Fig. 2.39 embryo at birth

The foetus takes about 280 days to complete development inside the uterus. This period is known as pregnancy.

At 3 months the foetus takes the human shape while at about 5 months the heart beat can be heard distinctly. At 6 months eyelids open. At birth the nails are fully grown. Testis descend to the testicles. Fat deposited under the skin gives a full look to the limbs. Weight is about 2-3 kilograms. Nearing birth, the baby turns to a head down position, turning towards the neck of the cervix. At the completion of the pregnancy period, the womb muscles contract pushing the baby through the cervix into the vagina and finally out of the mother's body. Under natural conditions, the head of the baby has to come out first.

At the birth, oxitosin makes rythmic contractions of uterus wall which helps to pull the foetus out from the vagina. After the birth, Prolactic and oxitosin hormones stimulate the lactation.

Do you know?

Among children, sometimes there are twins. They can be easily identified as identical birth twins or un-identical twins. A fertilized ovum dividing completely into two gives rise to identical twins while two or more ova released at the same time getting fertilized by different sperms separately gives rise to un-identical twins.

Menstrual cycle in women

If the ovum released every month does not get fertilized, it will get self digested. With this occurrence, the hormones progesterone and oestrogen produced along with it also declines. Result is the break down of the internal lining of the uterine wall. The increased blood supply which was there by this time will also break down. This blood, along with some broken down uterine tissue will flow out of the vagina. This occurrence taking place roughly around every 28 days is known as the menstrual or oestrus cycle. Normally, bleeding goes on for about 3-4 days. The beginning of the menstrual cycle in girl is known as puberty.

Role of hormones in reproduction

Now, you know how spermatogenesis and ovulation take place. All these activities are directly controlled by hormones. The anterior pituitary of the pituitary gland (an endocrine gland) secretes two hormones **FHS** and **LH**. In the male, these hormones stimulate the interstitial cells of the testis to secrete a hormone called testosterone. **Testosterone** is responsible for the development of secondary sexual characteristics in in boys.

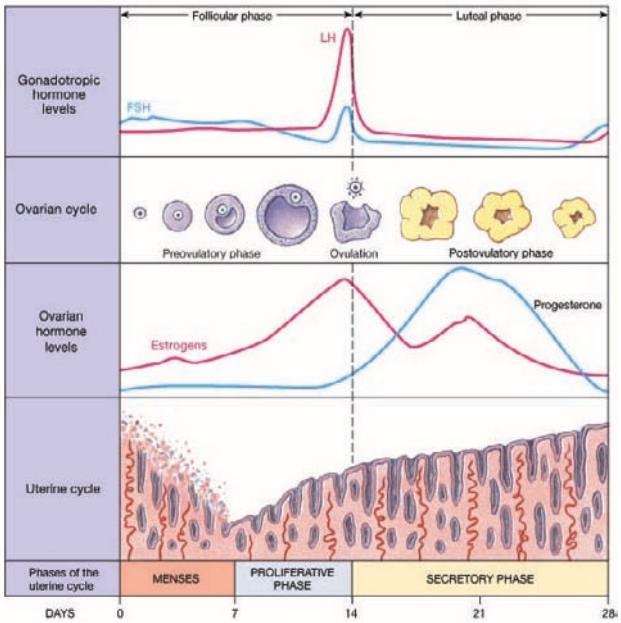


Fig. 2.40 Effect of hormones

In females, these hormones stimulate the ovary to produce the female reproductive hormones oestrogen and progesterone. If the ovum is fertilized, production of any more ova is prevented by progesterone. Fig 2.40 will clarify how hormones directly affect the development of ova and ovulation, and the growth and break-down of the uterine wall.

Sexually transmitted Diseases

Sexually transmitted infections are those diseases that can get transmitted from one person to another as a result of sexual contact between two persons. Around twenty diseases are been identified in this regard.

Among such diseases, the more common ones are gonorrhoea, syphilis, herpes and AIDS. Gonorrhoea and syphilis are spread by bacteria while herpes and AIDS are caused by virus. Most of the symptoms of sexually transmitted infections are limited to the sexual organs and not seen externally.

Syphilis

This is caused by the bacteria ***Triponema Pallidum.*** It is not very common,but is increasing among homosexual men. Three months after the entry of the bacteria sores appear, mostly around the sex organs. They are painless and disappear without treatment. After about six months,skin rashes and raised papules appear around the genitalia.These too disappear after sometime. At this stage, the disease may be cured with antibiotics. After a latent period of many years the nervous system may be affected leading to blindness, heart disease and insanity.

An infected woman can pass on the disease to the unborn child.It may die in the womb or at birth. If it survives, may become deaf or blind.

Gonorrhoea

Most common among this group of diseases. Caused by a *Gonococcus* type of bacteria. Symptoms are greenish yellow discharge at the tip of the penis, burning sensation during urination. If neglected, blindness and inflammation of joints of hands and feet may occur. Babies born to infected mothers may become blind.

Sexual herpes

This is caused by a virus *(Herpes simplex)*, as a result of sexual union with an infected person. Symptoms appear after about 5-7 days. Extremely painful sores appear. High fever and enlargement of lymph glands are symptoms. No treatment has been found. Disease can remain dormant and appear now and again.

AIDS

AIDS means A - Acquired
I - Immuno
D - Defieciency
S - Syndrome.

Here, a virus introduced from outside attacks the body's immune system. This means the body loses its ability to fight against infections, hence patients are open to any infections from bacteria, virus or fungi which are resisted easily by normal persons.

AIDS condition is the last stage of the infection. AIDS is caused by Human Immuno deficiency Virus. This virus enters the white blood cells of man and destroy their ability to fight. Hence his immunity breaks down completely. AIDS become fatal at this stage. After infection, a person may not show any symptoms of the disease for a period of about 2-15 years. They are perfectly normal in appearance or activity, yet they can be carriers of the disease. After reaching the AIDS stage of the disease they will show symptoms such as extreme tiredness, fever, diarrhoea, loss of weight, coughing and heavy breathing, thrush and enlargement of lymph glands.

AIDS cannot be cured. It can affect persons of any age or status and it is fatal.

You cannot get AIDS by sharing things with an infected person, by touching, by breathing the same air or working with them.

Do you know?
Aids infection is not only by sexual contact, but an infected mother can give the infection to the baby in delivery or by breast feeding.

Correct attitudes and practices with respect to sexual behaviours can safeguard a person from sexually transmitted infections. Numbers of HIV infected persons may increase in the future. It will then become not only a health issue but also a social issue because the public does not have positive attitudes about **HIV** persons and vice versa. As a result HIV infected persons suffer in many ways. They feel condemned from society. Society will lose valuable human-power as a consequence. As well, all the persons in the society should be well awared and should have correct attitudes, in order to eradicate this disease.

Reproduction and survival of organisms

In fertilization, fusion takes place between the two most important components of the nucleus, that is the chromosomes. The chromosome number of a species is specific to that species. Human beings have 46 chromosomes, that is 23 pairs. During fertilization these chromosomes join up with each other. The formation of 46 pairs or 92 chromosomes as a result of fertilization is avoided by an interesting process called **cell division**.

Cell division takes place in two ways, that is **meiosis** and **mitosis.**

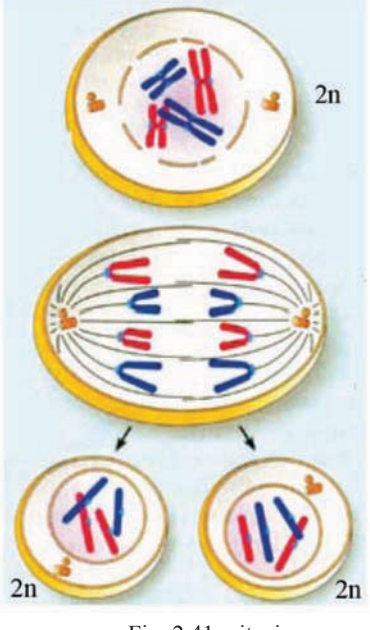


Fig. 2.41 mitosis

Mitosis

Let us consider mitosis first. Every vegetative cell in our body divides by mitosis. In this process all the characteristics of the mother- cell are transferred to the daughter cells, so that the two new cells are a replica of the former cell. (Fig 2.41)

Meiosis

Meiosis occurs during gamete formation in sexual reproduction. The 23 pairs of chromosomes of the parent cell is halved during this process, so that each gamete has only 23 chromosomes. Not only is the number of chromosomes halved but also the characteristics get mixed during this division.

Hence the gametes may have different characteristics from the parent cell. Such a gamete has to join up with another gamete to get the full cmponent of 23 pairs which occurs during fertilization. Can you think of the significance of this in the continued survival of a species?

Cells in the walls of the ovaries and the seminiferous tubules divide many times by mitosis and form the mother cells which divide by meiosis to form the gametes. No two ova nor two sperms are alike at any time. Therefore the two types of cell divisions offer the opportunity to produce individuals who are not only different but also diverse from one another. The diversity caused in this manner through sexual reproduction produce offspring with more suitable characteristics in the struggle for survival.

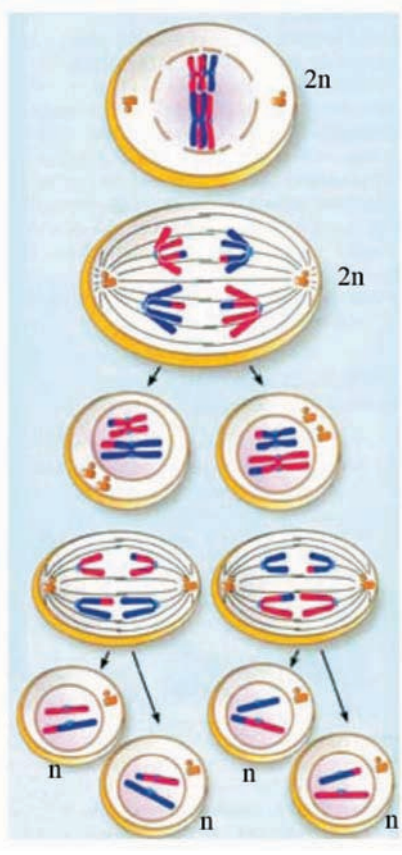


Fig. 2.41 meiosis

Comparison of sexual and asexual methods of reproduction

Asexual reproduction	Sexual reproduction
Contribution is only from the mother organism	Male and female organisms are involved. Some have both systems.
Gametes are not formed.	Haploid gametes are formed.
Meiosis does not take place	Meiosis takes place
Daughter cells similar to mother cells	New cells very different
Does not produce new species suited to environment	Produces offspring more suited to environment who will get selected.
Will produce many offspring in a short time	New offspring produced slowly
Seen mostly in plants. In animals seen among lower forms.	Seen among many plants and animals.

Producing more adapted and suited organisms to the environment ensures the continuity of life. The major contribution for this comes from sexual reproduction. Meiosis in sexual reproduction brings about genetic variations among organisms. The gene pool becomes bigger. Even though asexual methods do not bring about variety, they too have a special role in maintaining the continuity of life. Asexual methods contribute considerably to the continuance of the plant world. Hence from the day life started, till today and may be tomorrow as well, asexual as well as sexual reproduction will play an important role in the continuity of life on earth.

Excercises

(1). Potatoes that are bought from the fair on a rainy day were spread on a cool place. After few days the potatoes became green in colour.

(i). What is the reason for the green colour?

(ii) Due to the green colour of the potatoes, what will be the special biological activity which will happen inside them?

(iii). After few days, some 'buds' were seen on the potato tubers. Is it possible to obtain new plants from these buds?

(iv). Name two other plants which can be propagated by means of underground stems.

(v). Write three similarities you can see among underground stems and aerial stems.

(2). Flowers take various shapes and colours due to their accessory parts. But the gynoecium and androecium are the basic elements of a flower.

(i). Draw a diagram of the gynoecium of a flower in order to show the main parts, and label the parts.

(ii) What is the name used for flowers which has the gynoecium only?

(iii). Write two adaptations that can be seen in flowers to promote cross pollination.

(iv). Write two changes that take place in the ovum after fertilization.

(v). What are the accessory parts that remain on the fruits of Jambu and Guava.

(vi). Write two adaptations for dispersal which can be seen in the Coconut and Arecanut fruits.

(vii). Explain the importance of dispersal of seed in plants.

(3). Uterus is a special organ which belongs to the female reproductive system.

(i). What are the main parts of the felame reproductive system.

(ii) List the special features that the uterus posseses for bearing the featus.

(iii) What is the special structure organised for exchanging substances between the embryo and the mother.

(iv) Write two substances that pass from mother to the feotus and featus to mother.

(v) What are the special properties of breast milk?