

Modes of Reproduction

There are two kinds of reproduction :

Sexual reproduction is characterized by the fusion of two cells (**gametes**) usually coming from two parent.

Asexual reproduction on the other hand, is other type of reproduction that does not involve the union of gametes. New individual is produced from a single parent.

Sexual Reproduction in Plants

The life of most plants begins in a seed. The plants that reproduce seeds are of two kinds. Flowering plants produce seeds through a process called sexual reproduction. Non-flowering plants such as cedars, pines and firs produce seeds in cones. The seeds grow into new plants.



A flowering plant



A non-flowering plant

Do You Know ?

Biologists believe that the last common ancestor to all lives on the earth lived about 3.5 billion years ago.

STRUCTURE OF A TYPICAL FLOWER

A flower is the reproductive part of a plant. All flowers develop from a bud. A bud in the initial stage, is usually green and consists of sepals. The **sepals** protect the parts of a flower before it blooms.



Activity Time

To observe the reproduction in plants

Take a warm water in a beaker and dissolve a spoonful of sugar in it. Add about 10gm of yeast powder. Keep the beaker in a warm place. After an hour, put a drop of the solution on a glass slide.

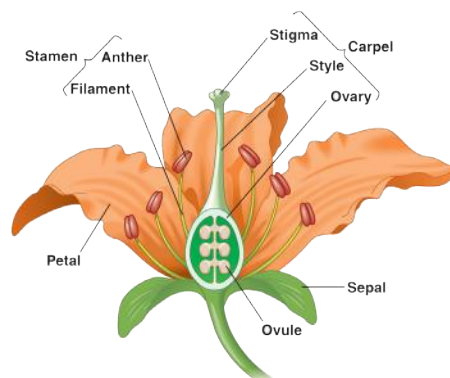
Observe under the microscope.

What do you observe ?

A few yeast cells have buds arising from them.

Petals are either coloured or white and are seen only when the flower blooms. They usually attract insects. The sepals and petals do not directly take part in reproduction.

A stamen is the male reproductive part of a flower. The stamen consists of a long, narrow filament with an anther at its tip. Anthers produce pollen grains, from the male gametes. Pollen grains appear as a powdery material on the anthers.



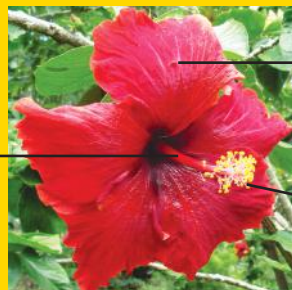
Parts of a flower

The pistil is the female reproductive organ of the flower. It is made up of the stigma, style and ovary. The style is a long, narrow tube rising from the ovary. The tip of the style is called stigma. The ovary is the swollen part at the bottom of the pistil. It contains one or more ovules. Ovules contain the egg cells, the female gametes of the plant.



Activity Time

Observe the flower. Identify its parts.



Flowers are of two types unisexual and bisexual.

Unisexual Flower

Some plants have separate male and female flowers. The male flower has only the male reproductive parts, namely the stamen. The female flower has only the pistil which is the female reproductive part. Flowers which contain either the male or female reproductive parts are unisexual. Watermelon, papaya and chilli plants have unisexual flowers.



Unisexual flowers in watermelon



Hibiscus- a perfect flower

Bisexual Flower

Plants like lilies and hibiscus are flowers which have both the male and female parts in the same flower. This means the flower has both stamens and pistil. Such a flower is called a bisexual or a perfect flower.

WHAT IS POLLINATION?

The pollens are formed in the anther of stamen. The transfer of pollen from the stigma within flowers or from one flower to another of the same kind is called pollination.



Self pollination

If pollen from a flower reaches the stigma of the same flower, or another flower on the same plant, it is called self pollination.

When pollen from a flower reaches the stigma of a flower of another plant of the same kind, it is called cross-pollination. In cross-pollinated plants, the pollen grains are carried from flower to flower by birds, insects, bats or wind.



Cross pollination

Do You Know ?

The Amazon water lily bears leaves measuring upto 7 feet in diameter and flower between 12 to 16 inches. The flower are white the first night and turn pink to purple after they have been pollinated.

Many insect-pollinated plants have flowers with large colourful petals, sweet scent and nectar. These features attract humming birds and insects such as ants, bees, beetles and butterflies. Some flowers that open at night are pollinated by nectar-feeding bats and moths. Such flowers are mostly white. As these animals move from flower to flower in search of nectar, they carry pollen on their bodies and transfer them from flower to flower.

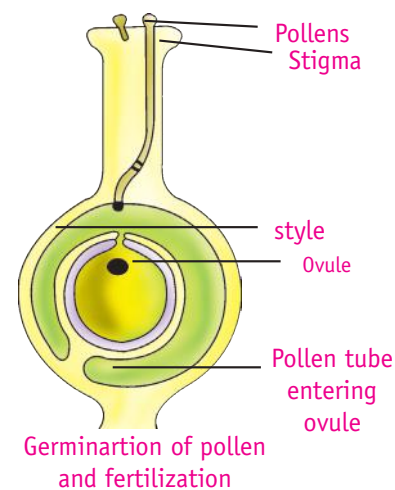
Plants whose flowers are pollinated by wind produce many small flowers, usually in large clusters. The wind-pollinated flowers such as those of grasses do not have colourful petals. They do not produce nectar. They produce abundant pollen grains that can be carried by wind.

FERTILIZATION

When a pollen grains falls on the stigma of a flower of the same kind, it develops a long tube called the pollen tube. The pollen tube grows downwards through the style towards the ovary.

The male gametes are formed inside the pollen tube.

When the tip of the pollen tube reaches the ovary, it opens and a male gamete enters the ovule. The male gamete then unites with the egg. This is known as fertilization. It is a process in which the male gamete fuses with the egg and fertilizes it. The fertilized egg is called the zygote.



Activity Time

Observe the parts of a flower

Take a geranium flower and observe the flower. You will see it has whorls of different structures : sepals, petals, stamen and pistil. Remove each whorl and examine under a hand lens. Draw them in your practical copy.

Examine the stamen and the pistil. Squeeze the anther to see the pollen grains. These carry the male gamete, which are equivalent to the sperm cell in animals.

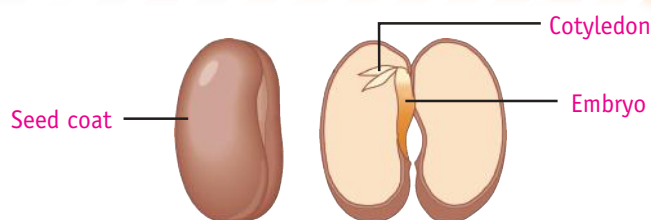
Cut open the pistil at the base and observe the female part of the flower.

Seed

The fertilized egg cell begins to divide and develops into an embryo, The embryo develops into a seed. The seed coat is the outer covering of the seed.

Soak a bean seed overnight. Carefully, remove the seed coat. What do you observe inside the seed ? You will be able to see an embryo attached to the cotyledons of the seed.

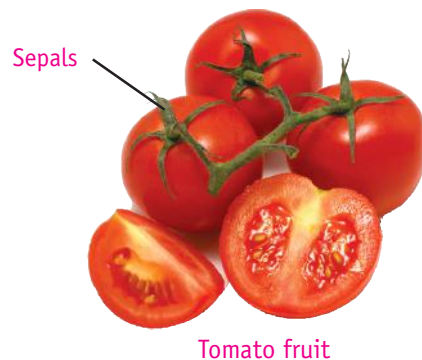
The embryo has a radicle, plumule and is attached to one or two cotyledons. The radicle will develop into the shoot system upon germination. It also has a store of food. The fully formed seed loses most of the water. As a result, the seed coat dries and becomes hard and strong. This helps in protecting the embryo inside.



Fruit

In most plants, the fruit begins to form only after the egg cells have fertilized.

After fertilization, the ovary begins to grow in size. The outer wall of the ovary becomes thick and forms the fruit. The petals and the stamens mostly dry and fall off. Once the seeds inside the ovary have fully developed, the fruit ripens.



Activity Time

Seed germination

Collect fruits of some raw and ripe vegetables of the gourd family, for example, white gourd (dudhi) and bitter melon (karela). Cut open the fruits. Remove the seeds. Observe the colour of the raw and ripe fruits.

What is the difference between the seeds of a raw fruit and a ripe fruit ? Will seeds from a raw fruit germinate ?



Seeds from a raw fruit do not germinate because they are not fully formed. When seeds get the favourable conditions, they germinate, if soaked in water and kept in a warm place. The food stored in the seed is used by the seedling.

DISPERSAL OF SEEDS

You have learnt that a seed contains the embryo which grows into a plant. A plant may produce large number of seeds. Each seed requires space, minerals, sunlight and water for its development. If all the seeds produced from a plant fall below the plant, they will compete with each other for these requirements and may not get enough of these. Many of these seeds may die also.

Nature, therefore, has developed a few novel methods by which seeds can be scattered over a large area, This is called seed dispersal. It helps the seedlings to avoid competing with each other, enables the plant to invade new habitats and helps in the distribution of the species.

The dispersal seeds can be carried by various methods of agents. Some of these are described here.

Wind

Certain seeds have developed several adaptive features which help them to be dispersed by the wind. For example :

Seeds of drumstick and maple have wings attached to them.

- Seeds of cotton, calotropis and dandelion have hairs around them.
- Some seeds like those of grasses are light in weight.



Calotropis seeds



Maple seeds

Seeds dispersed by wind

Water

Some seeds are dispersed by water. For this, they have developed special mechanisms by which they float on water. For example :

- The lotus fruit has a spongy part and is light in weight.
- The coconut seed has thick fibrous coat.



Lotus seeds



Coconut

Seeds dispersed by water

Animals

Certain seeds are carried to far-off places by certain animals. They can be carried by various means, as given below :

- The spiny and hooked seeds, such as Xanthium, Achyranthus, Chrysopogon and tiger tail, get attached to the fur of animals, our clothes and are carried along.
- Sometimes, animals eat seeds along with the fruits. These seeds remain undigested and pass out with faeces at some other place.



Achyranthus seeds



Xanthium seeds

Seeds dispersed by animals

DISPERSAL BY EXPLOSION

In some plants like lady's finger, the dried fruit explodes spreading the seeds away from the mother plant.



Lady's finger, dispersal by explosion

Asexual Reproduction in Plants

Some plants can multiply without sexual reproduction. In other words, male and female reproductive parts do not contribute in the process of the formation of new plant. Such a process is called asexual reproduction or vegetative propagation.

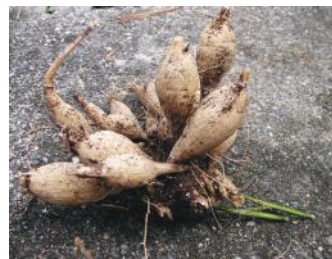
Any vegetative part of a plant such as the root, stem, leaf or flower may be propagated into a new plant. New plants can grow by the separation of parts from the original plant.

Most plants which reproduce vegetatively in nature usually have small daughter plants growing around them. The most common example is banana.

Vegetative Propagation through the Roots

Tuberous roots of sweet potato and dahlia when detach from the parent plant can grow into a new plant. The swollen tuberous roots are rich in sugar.

Such roots can be stored and sown in the next sowing season.



Dahlia

Sweet potato

Propagation through the roots

Vegetative Propagation through the Stem



Ginger



Turmeric

Propagation through the stem



Canna

Rhizome

Rhizomes : Plants like ferns, bamboo, ginger, banana, canna and turmeric propagate from underground stems that grow horizontally. They are called rhizomes. Rhizomes grow and develop buds. The rhizomes can be cut into sections so that each contains at least one bud. The bud grows into a new plant.

Tubers

Potato is a modified stem and has buds. When a piece of potato containing a bud is planted into the soil, it grows into a new potato plant. Propagation by this method produces new potato plants quickly.



Potato

Runners

Many plants have long, thin stems called runners that grow horizontally parallel to the ground. A runner most often takes roots and sprouts new leaves wherever it touches the soil. This gives rise to new plants. Most types of grasses and the strawberry plants propagate in this manner in natural conditions. Suckers are very similar to runners.



A runner



Strawberry plant



Garlic



Onion

Bulbs

Bulbs are found in garlic, onions, lilies and tulips. They are thick, short, underground stems which contain abundant reserves of food. They contain buds which grow into new plants.

Cuttings

Many plants like money plant, sugarcane and rose are grown through cuttings from their stems.

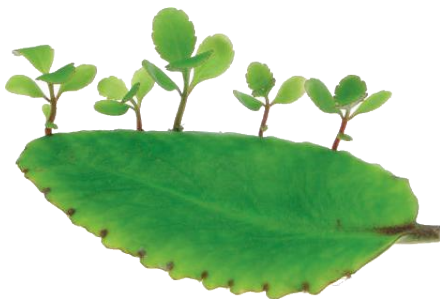


Activity Time

Reproduction by cutting

Gently cut a healthy piece of stem from a rose plant. Plant the piece of stem in a pot. Place it in shade. Keep the soil moist.

Observe how many buds the stem has. In a few days time, when a new shoot emerges from one of these buds, a new rose plant has formed. It has formed through vegetative reproduction.



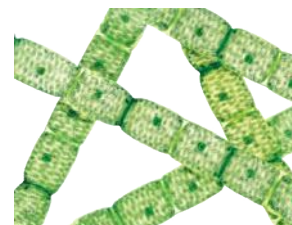
Bryophyllum, leaf with plantlets

VEGETATIVE PROPAGATION THROUGH LEAVES

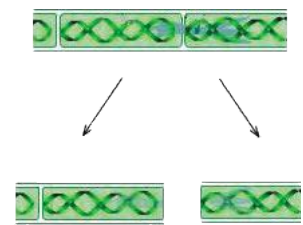
The leaves of bryophyllum plants produce buds on their margins. When these leaves get detached from the plant and touch moist soil, the buds grow into new plants.

Vegetative Reproduction through Fragmentation in Algae

The green patches that float in ponds and fresh water puddles are algae. They do not have specialized parts like leaves, stem or flowers. These plant-like living things multiply or reproduce by fragmentation.



Microscopic picture of spirogyra



Fragment in spirogyra

Spirogyra is a common fresh water algae. It grows as fine strands. When conditions are ideal and enough nutrients are available in the water, the algae breaks into fragments on its own. Each fragment grows into a new plant.

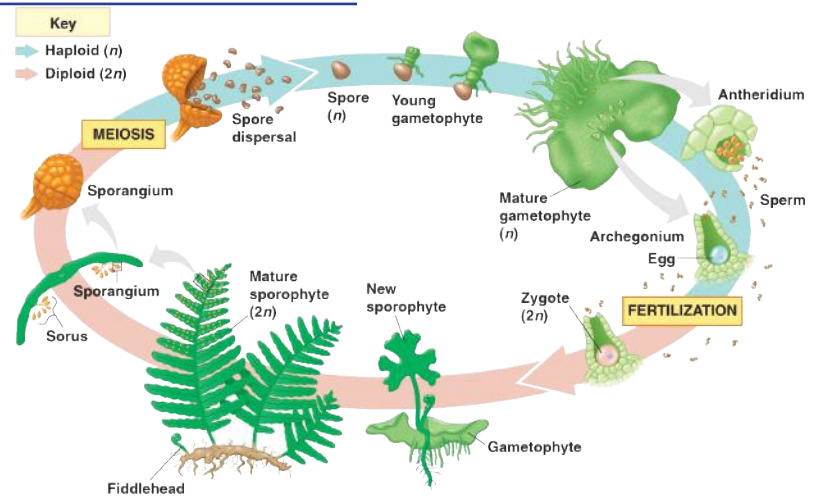
REPRODUCTION IN FERNS

Some plants like ferns reproduce both sexually and asexually. A fern plant has specialized leaves with dark brown bodies which produce spores. When a spore falls on the ground, it develops into a heart-shaped plant body. This heart-shaped plant body produces male and female gametes.

The male gamete fertilizes the female gamete (egg). The fertilized egg develops into a new plant. The formation of a fertilized egg involves sexual reproduction.

Thus, a life cycle of a fern plant involves both asexual and sexual reproduction.

Plants are not the only organisms that reproduce asexually through spores. Vegetative reproduction through spores. Vegetative reproduction through spores is also found in fungi such as yeast.



Life cycle of a fern plant



Activity Time

Vegetative Reproduction

Take half cup of warm water. Add a teaspoonful of sugar and mix it. Add a pinch of yeast to the sugar solution and leave the preparation undisturbed till morning. Next morning, take the solution to school. Stir the solution gently and take a drop of it on a glass slide.

Place a cover slip on the slide and observe it under a microscope. You will see many yeast cells. Some of the yeast cells will have developed spores indicating that they are reproducing.

Artificial Methods of Vegetative Propagation

Artificial methods of vegetative propagation are widely used in agriculture and horticulture. Cuttings, budding, grafting, layering and tissue culture are some methods of artificial propagation.

Cuttings

Plants like rose, bougainvillea can be propagated through cuttings from their stems. When a cutting of these plants is buried in soil, new leaves grow from the nodes.



Grafting

In this method, a plant that is strong and resistant to disease is taken as the base plant. It is called the stock. A stem cutting (graft) from another plant of a good variety is inserted on the stem of the stock through a small incision. The graft and the stock are firmly bound together. In a few weeks time, the tissues of the stock and the graft fuse together. The stock provides the root system and the lower part of the new plant. The stem cutting becomes the upper part of the grafted plant and provides the stem, flowers and fruits. Grafting is commonly used for propagating trees and shrubs.



Grafting



Layering

In plants like jasmine and grapewine, the lower branch of the plants is bent down and covered with moist soil after removing a ring of bark from the stem. After a few weeks, new roots develop and the plant is separated from the mother plant.

Tissue Culture

Tissue culture is an artificial method of vegetative propagation. It is undertaken in specialized laboratories. It is based on the principle that a new plant can be grown from a single cell. A piece of stem, leaf or root (tissue) is placed under special conditions in a semi-solid solution containing nutrients and plant hormones in a closed container with the plant tissue is incubated under specific conditions of light and temperature. The cells of the tissue divide and each gives rise to a new plant. Through tissue culture, many plantlets can be regenerated from a single piece of tissue.



Know the Keywords :

Reproduction : Production of young ones of one's own kind.

Sexual reproduction : Reproduction involving formation and fusion of gametes.

Asexual reproduction : Reproduction without the involvement of gametes.

Bisexual flowers : Flowers with both male and female reproductive organs.

Unisexual flowers : Flowers with either male or female reproductive organs.

Seed dispersal : The distribution of seeds to an area away from the place where they are produced.

Budding : Formation of a small bulb-like projection develops from a cell to form a new individual.

Fertilization : Fusion of male and female gametes.

Fragmentation : Breaking up of body into two or more pieces to produce new individuals.

Pollination : Transfer of pollen grains from the anther to the stigma.

Vegetative propagation : Production of new plants from the vegetative parts of the plant.

Point to Remember

- Reproduction can be defined as the production of young one's of their own kind.
- The transfer of pollen from the stigma within flowers or from one flower to another of the same kind is called pollination.
- Grafting means a stem cutting from another plant of a good variety is inserted on the stem of the stock through a small incision.

EXERCISE TIME

A. Answer the following questions :

1. What do you understand by sexual reproduction ?
2. What is a bisexual flower ?
3. Why is pollination necessary for the development of fruit ?
4. What is vegetative reproduction ? Explain with an example.
5. How do ferns reproduce ?
6. Differentiate between cross-pollination and self-pollination.
7. How do wind and bees help in the formation of seeds ?
8. What is tissue culture ?

B. Fill in the blanks :

1. Stamen is male part of flower and _____ is female part of flower.
2. If _____ is rhizome then potato is tuber.
3. If ovary is fruit then _____ is seed.
4. If _____ : male, gamete; egg : female gamete.
5. If fungi : spore formation; spirogyra : _____.
6. The _____ develops inside the ovule.

C. Tick (✓) the correct option :

1. A chilli flower is unisexual because it has :
 - (i) stamens and pistils
 - (ii) either a pistil or stamens
 - (iii) petals and pistils

2. If a plant has tiny, petal-less flowers, it most probably will be :
- (i) self-pollinated (ii) cross-pollinated (iii) wind-pollinated
3. When pollen from a flower reaches the stigma of a flower of another plant of the same kind, it is called :
- (i) self-pollination (ii) cross-pollination (iii) fertilization
4. An insect-pollinated flower will most probably have :
- (i) colourless petals
- (ii) colourful sepals
- (iii) large colourful petals
5. A night blooming flower will be pollinated by :
- (i) moths and bats (ii) humming birds (iii) butterflies



Creative Work

- You will need a large bryophyllum leaf with its stalk, a sheet of newspaper, some water, a glass tumbler.
- Place the bryophyllum leaf on a sheet of newspaper. Next morning, transfer the leaf into a tumbler filled with water in such a way that only a part of the leaf stalk remains immersed in water. Leave the arrangement undisturbed for about three weeks. What do you observe ?