The Flower

Different Parts of a Flower and Their Functions

You must have seen flowers growing on a plant. **But do you know that there are some plants that do not bear flowers?**

Plants that have flowers and produce seeds and fruits are called **flowering** plants such as apple, mango, tomato etc. while the plants that do not produce flowers, seeds, fruits are called **non-flowering** plants such as ferns, mosses etc.

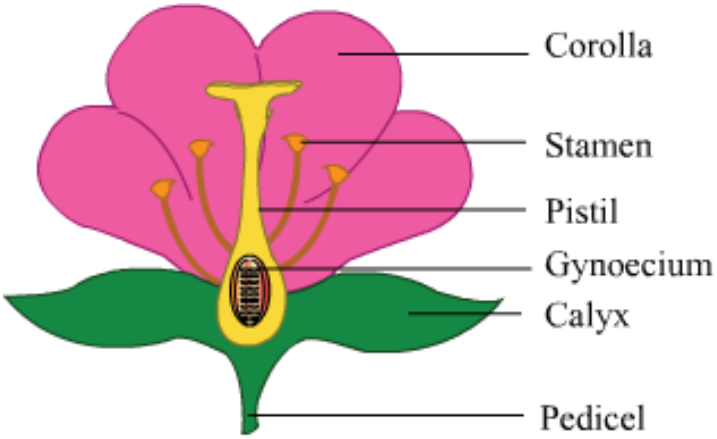
What are flowers and what are their functions in plants? Let us explore the answers to these questions.

Flowers are the brightly coloured parts of a plant. They are involved in the formation of fruits.

What are the different parts of a flower?

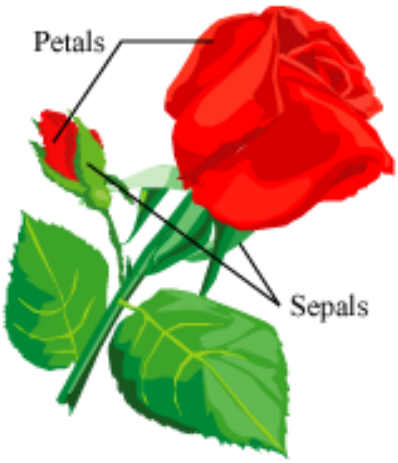
Parts of a flower

A flower usually consists of four main parts:



1. Calyx- The leaf-like structure at the base of the flower that protects the flower in the bud stage is called calyx. Individually it is known as sepals.

2. Corolla- This part of the flower is often bright in colour and unusually shaped to attract insects for pollinations. All the petals together are called corolla.



- **Sepals**

  They are the small, leaf-like green structures of a flower. They can be clearly distinguished as separate structures in flowers such as rose, marigold, etc. However, sepals are found to be fused in flowers such as periwinkle, *Hibiscus*, etc.

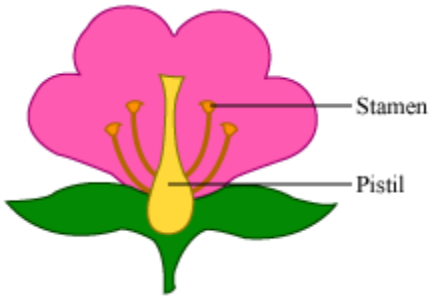
- **Petals**

  They are the brightly coloured, prominent parts of an open flower.

  3. Androecium-This is the male reproductive part composed of stamens and each stamen consists of a filament and an anther.

  4. Gynoecium- This is the female reproductive part of the flower composed of carpels and each carpel have 3 parts- stigma, style and ovary.

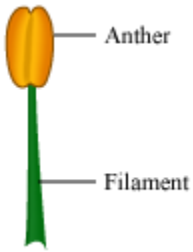
  Stamens and pistils are the two reproductive parts of flowers.



- **Stamens**

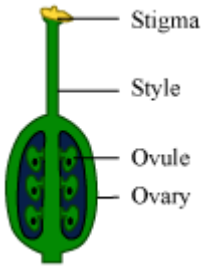
  They are the male reproductive parts of plants. They can vary in number. A stamen is divided into two parts: anther and filament.

Stamens can be free, such as those present in *Hibiscus*, pea, marigold, etc., or they can be joined to petals, such as those in *Datura*, potato, sunflower, etc. The anther contains a number of pollen grains.



- **Pistils**

  They are the female reproductive parts of plants. They are present in the innermost parts of flowers. They consist of three parts: stigma, style, and ovary.



  Ovary is the lowermost, swollen part of the pistil. It contains one or many small, bead-like structures called **ovules**. These ovules are attached to the ovary wall with the help of structures called placenta.

  These ovules develop into seeds, and the entire ovary (containing the ovules) develops into a fruit.

  On the basis of presence or absence of male and female reproductive parts, flowers are classified into two main groups.

- **Bisexual (hermaphrodite) flowers:** These are the flowers that have both androecium and gynoecium parts. Examples include rose, lily, sunflower, mustard, etc.
- **Unisexual flowers:** These are the flowers that have either androecium or gynoecium part. Examples include coconut, papaya, cucumber, watermelon, etc.

  Functions of a Flower

  The main function of a flower is aiding in reproduction.
  The flower contains the stamen and the pistil that are involved in reproduction.

The pollen grains from the stamen are transferred to the pistil, this process is known as pollination.
Pollination takes place with the help of wind, water, insects, birds and other animals.

Dissecting a flower

Take a fresh flower, for e.g. *Gulmohur*. Observe the prominent parts (sepals and petals) of the flower. Now, remove all the sepals and petals to see the rest of the parts.

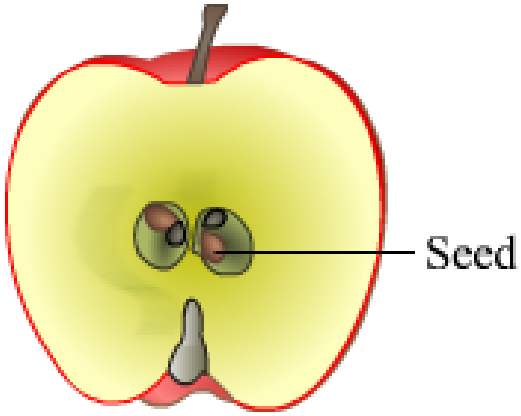
Can you count the number of stamens in the flower?

Some interesting facts:

- Did you know that *Wolffia* is the world's smallest flower? Its entire body (including the flower) is less than 1 mm long!
- *Rafflesia arnoldii* is the world's largest flower. It is a parasitic plant. It measures around 3 feet across and weighs up to 15 pounds!

Fruits

After pollination, the ovary changes into the fruit and the ovules present inside the ovary change into seeds. The seeds fall off from the plant and under favourable conditions, germinate into a new plant.



Pollination and Fertilization

Pollen grain and egg are male and female gametes respectively. **How does the pollen grain reach the ovule to fertilize the egg?**

Pollen consists of a tough protective coat, which prevents it from drying. Pollen grains are light and are easily carried away by the wind. In some plants, insects sit on flowers and carry the pollen on their bodies.

Therefore, various agencies such as wind, insects, water, etc. carry the pollen to the stigma of the flower. **The process of transfer of the pollen from the anther to the stigma is known as pollination**. Pollination is of two types. Let us study what these types are.

Agents of Pollination

Plants use air, water (abiotic agents), and animals (biotic agents) for pollination.

Pollination by wind

- It is the most common form of abiotic pollination.
- Plants, which are wind-pollinated, possess well-exposed stamens and large, feathery stigma.
- Pollens should be light and non-sticky to be carried easily by winds.
- Wind-pollinated flowers often have single ovule in the ovary and numerous flowers packed in an inflorescence.
- It is common in grasses.
- They neither possess any smell nor nectar.

Pollination by water

- It is rare in flowering plants, except for some aquatic plants such as *Vallisneria* and *Hydrilla*.
- In most water-pollinated plants, the pollen grains are long, ribbon-like, and are protected from wetting by mucilaginous covering.
- In a majority of water plants such as water hyacinth and water lily, flowers emerge above the water level and are pollinated by insects.

Pollination by insects

- Majority of flowering plants use butterflies, bees, wasps, etc. for pollination.
- Most of the insect-pollinated flowers are large, colourful, fragrant, and contain nectar to attract the animal pollinators. These are called floral rewards.

- Floral reward can be in the form of providing safe places to lay eggs. (example: the tallest flower, *Amorphophallus*)
- The pollen grains are sticky and get stuck to the body of the pollinator.
- Certain animals such as birds, squirrels, bats, etc. also act as pollinators.

Artificial Pollination

- It is a practice adopted by plant breeders to pollinate a given flower artificially or manually.
- It is done to obtain new crop varieties with desirable characters.
- In this, the anthers of a desirable plant are first removed at a very young and the flower is completely covered by plastic bags to avoid any unwanted pollen to settle on stigma through cross pollination.
- Once the flower gets mature, it is pollinated with the pollen from the desired plant variety.

Which process takes place after pollination?

After pollination, **fertilization** takes place.

The process of fusion of the male and female gamete is known as fertilization.

Let us study how fertilization takes place in plants.

After the pollen grain reaches the stigma, pollen tube grows and reaches the ovary passing through the style. Male cell travels down the pollen tube and fuses with the egg cell in the ovule. This fusion is known as fertilisation.

After fertilisation, the ovary of the fruit develops into the fruit and ovules develop into the seeds.

The fruits developed from a ripened ovary fall under various categories:

- Fleshy fruits: Developed from an ovary with fleshy walls. Examples include papaya, tomato, etc.

- Dry fruits: Developed from an ovary with dry walls. Examples include pea, maize, etc.

- False fruits: Fruits in which the fleshy part that we eat develops from thalamus (present at the base of the flower) and not the ovary. The ovary remains at a small region at the centre around the seeds. Examples include apple, pear, etc.

Some interesting facts:

Do you know why flowers are brightly coloured and strongly scented? This is because the colour and fragrance of flowers attract insects for pollination.
Honey bees help in pollination in a large number of plants.
Some flowers look like an insect to attract other insects for pollination.
Some plants are pollinated by bats.

Formation of Fruits and Seeds

We know that plants produce fruits.

When and why do plants produce fruits? Let us explore.

Seeds are present inside fruits. **Have you wondered why? Why do plants produce seeds inside the fruits?**

After fertilization i.e. after the fusion of male (pollen) and female (ovule) gametes:

- The **ovary gives rise to the fruit,** while the other structures of the flower fall down. **Thus, the fruit is a ripened ovary.**

- The **ovules present inside the ovary develop into a seed**. Seeds contain an embryo, which is protected by the seed coat.

Therefore, seeds when sown in the ground can give rise to new plants because they contain an embryo.

Seeds are present inside the fruit for protection. When fruits fall on the ground, seeds are protected and can grow into new plants. The fruit provides nourishment to the seeds.

A fruitful observation!

Visit a nearby market and observe different types of fruits available there. Observe the difference in the shape and size of fruits. Cut some fruits and observe the structures of the seed.

Do all seeds have a similar structure?

Do you know that seed of double coconut is the largest seed in the world?

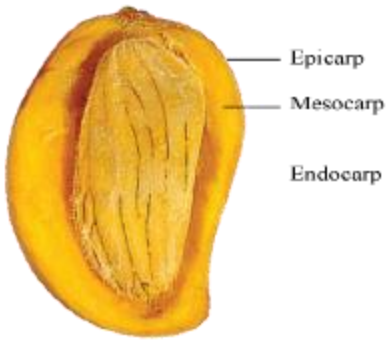
Fruit

A fruit consists of two portions – pericarp and seed.

Pericarp – Pericarp is the part that develops from the wall of the ovary. Pericarp may be thick or thin. It consists of three portions:

- Epicarp – The outer and leathery part of the fruit is called epicarp. It is usually not eaten.
- Mesocarp – It constitutes the sweet, fleshy part that is usually eaten by us.
- Endocarp – It is the innermost hard layer that contains the seed. You all must have noticed a white seed present inside the thin endocarp of an unripe mango.

The nature and presence of the three parts may vary for different fruits. In fact, in some plants, pericarp is not at all differentiated into three parts.



Functions of a fruit

- It protects the seeds from animals and harsh weather conditions.
- It helps in seed dispersal. We will learn more about seed dispersal later in this chapter.
- It stores food material.

Seed

Seeds are the mature ovules. Seeds vary greatly in their appearance and form.

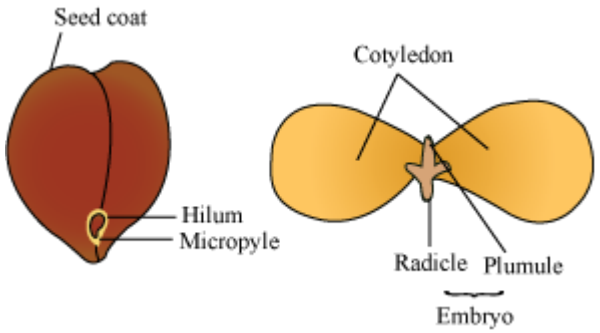
The outer part of the seed is called the **seed coat**. It is a hard outer covering consisting of two layers: outer exposed, hard layer, called **testa**, and inner thin, membranous layer, called **tegmen**. The purpose of seed coat is to protect the seed from insects or bacteria

and from any physical damage.
On the lower end of the concave side of seed is a scar, called **hilum**. It actually represents the place where seed was attached to the ovary wall. Just above the hilum is a small pore, called **micropyle**. It helps in absorption of water during seed germination and in exchanging gases through diffusion.

On removing the seed coat, we will observe the following parts:

- **Cotyledons** – Cotyledons may be one or two depending upon whether the seed is monocot or dicot.

- **Axis** – Axis is a short, curved structure to which cotyledons are attached. Axis consists of two parts, one of which develops into **plumule (future shoot)** and the other one develops into **radicle (future root)**.



Under proper conditions, seed germinates to form new plants.

The seeds that we use as a part of staple food diet can be distinguished into pulses, millets, cereals and grains

- **Pulses**- They are primarily seeds occurring in variable sizes and colours inside a type of fruit called pod. All pulses, like black gram, pea, lentil belong to the pea family- Leguminosae. They are rich source of proteins.

  India is the largest producer and consumer of pulses.

- **Grains**- They are small, hard dry seeds with or without the fruit wall attached. Variety of grasses belonging to the family Poaeceae produce grains. Most of the grains are generally cereals like maize, rice, wheat, etc.

  Maize, rice, wheat, barley, oats and sorghum are the common grains that account for more than 85% of the total grain production in the world.

- **Millets**- They are coarse grains with high protein content but smaller seeds. For example jowar, bajra and ragi etc.

Seed Germination

Germination is the process during which seed reserves present in the seed are broken down and the embryo starts to grow.

During germination, the seed absorbs water. Germination is irreversible i.e. once begun; the seed cannot be brought back to dormant state,

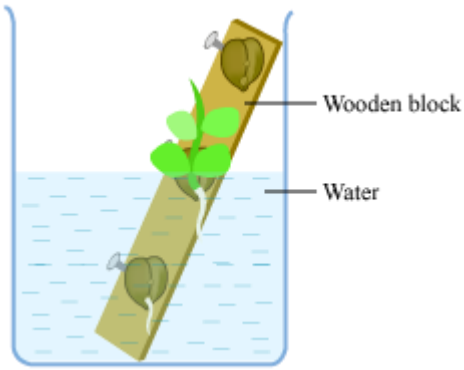
Seeds which do not germinate even after provided with all the conditions necessary for germination are called **dormant seeds** and the phenomenon is termed as **dormancy**.

Let us study what happens during germination

When a seed is germinating, the portion above the cotyledon that forms future shoots is called plumule and the portion below the cotyledon that forms the future roots is called radicle.

Conditions Necessary for Germination

Activity 1



- As shown in the figure, take a beaker with water and place it in, a glass slide with three bean seeds tied to it.
- The slide should be kept in such a way that the upper seed is completely out of water, lower seed is completely submerged in water and the middle seed is half submerged in water.
- The beaker is placed in warm temperature (25° C – 30° C) for few days.

Result

- Seed at top – Does not germinate

- Seed at middle – Germinates
- Seed at bottom – Does not germinates

Inference

- Seed at top gets only oxygen and no water. So it does not germinate.
- Seed at middle receives both oxygen and water. So it germinates.
- Seed at bottom gets only water and no oxygen. So it does not germinate.

Activity 2

- Take two petridishes with moist cotton placed in it.
- Place a few soaked seeds in both petridishes.
- Place the first petridish in refrigerator (4°C) and the second one at room temperature (30°C).
- Leave the petridishes for few days.

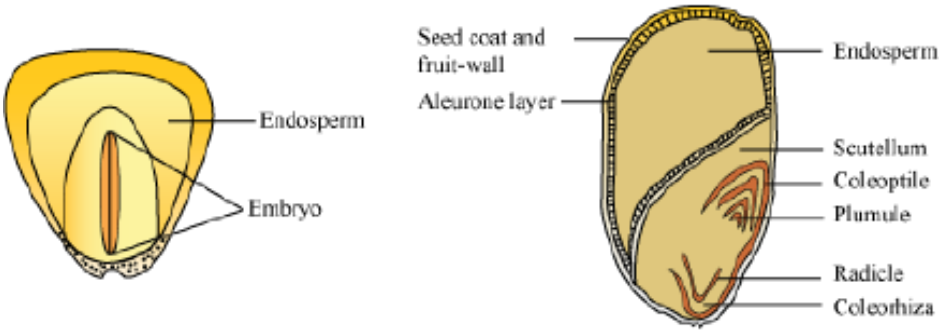
Result

- No germination was seen in the petridish kept in refrigerator while the seed present in the petridish kept at room temperature germinates.

Inference

- Suitable temperature is necessary for germination.

Structure of Monocot Seed



- In seeds of cereals, seed coat is membranous and fused to the fruit wall.
- Generally, monocot seeds are endospermous. Endosperm is bulky and stores food.
- Aleurone layer - proteinous layer that separates embryo from outer covering of endosperm
- Embryo is situated in a groove in endosperm. Embryo consists of
- cotyledon known as scutellum
- embryonal axis (consisting of plumule and radical)
- Plumule is enclosed in a sheath called coleoptile and radical in coleorrhiza.

So what does you concluded about the necessary conditions for seed germination?

Seeds require water, suitable temperature, and oxygen for germination. Let us see how these factors affect germination one by one.

Water

- Helps in rupture of seed coat by swelling the seed, so as to allow the elongated radicle to come out during germination
- Necessary for various biochemical reactions occurring within the seed

Suitable Temperature

- Moderately warm temperature (25ºC - 35°C) is suitable for germination of most of the seeds.
- Very low or high temperature can destroy the delicate tissues of the seed.

Oxygen

- Necessary for providing energy (through respiration) required for rapid cell division and cell growth

Types of Germination

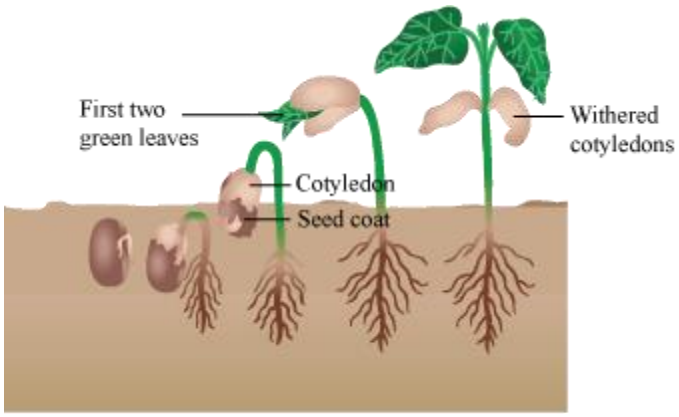
There are two types of germination patterns depending upon the behaviour of cotyledons during germination.

- Epigeal germination

- Hypogeal germination

Epigeal Germination

When the cotyledons are lifted above the ground as a result of rapid elongation of hypocotyls e.g. seeds of bean, castor, cotton, etc germinate in this manner.

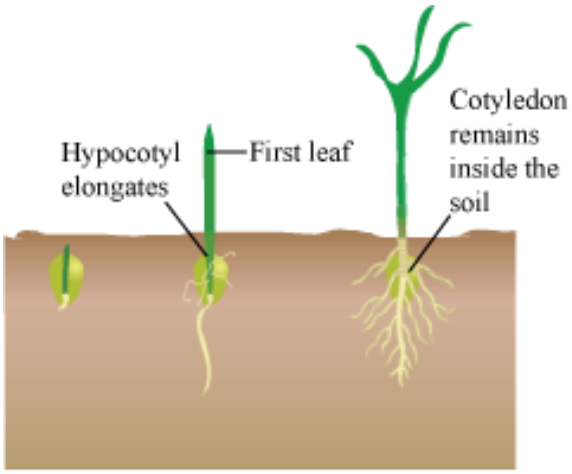


Epigeal germination in a bean seed

Hypogeal Germination

When the epicotyls elongates quickly and pushes the plumule up, and cotyledons are left on the ground only, the germination is hypogeal.

e.g. Gram, pea, maize, etc germinate in this manner.



Hypogeal germination in a maize grain

Viviparous Germination
A special mode of germination in which seed starts germinating inside the fruit while it is still attached to the parent plant. Once germinated, the seedling is dropped into the

soil where it fixes itself by developing roots.

Seedling: A very young plant that grows from a seed after germination. It consists of roots, that fix it in the soil and absorb water and minerals, and small young leaves which manufacture food for it.