



# **Sexual & Asexual Reproduction**

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## Key definitions

*Reproduction*:- it means making a copy, a likeness, and thereby providing for the continued existence of species.

*Sexual Reproduction*:- a type of reproduction that involves a complex life cycle in which a gamete (such as a sperm or egg cell) with a single set of chromosomes (haploid) combines with another to produce a zygote that develops into an organism composed of cells with two sets of chromosomes (diploid).

*Asexual Reproduction*:- a type of reproduction that does not involve the fusion of gametes or change in the number of chromosomes.

## Asexual vs. Sexual Reproduction

- Asexual Reproduction
  - Only one parent
  - Offspring are identical to parent
  - Usually through mitosis
- Sexual Reproduction
  - Two parents
  - Offspring are different from both parents
  - Uses meiosis (sperm and egg)



# Asexual Reproduction

Asexual reproduction is a mode of reproduction in which a new offspring is produced by a single parent. The new individuals produced are genetically and physically identical to each other, i.e. They are the clones of their parents.

Asexual reproduction is observed in both multicellular and unicellular organisms. This process does not involve any kind of gamete fusion and there won't be any change in the number of chromosomes either. It will inherit the same genes as the parent, except for some cases where there is a chance of rare mutation to occur.

## Characteristics

1. Single parent involved.
2. No fertilization or gamete formation takes place.
3. This process of reproduction occurs in a very short time.
4. The organisms multiply and grow rapidly.
5. The offspring is genetically similar.

## Types

- Binary Fission

The term “fission” means “to divide”. During binary fission, the parent cell divides into two cells. The cell division patterns vary in different organisms, i.e., some are directional while others are non-directional. Amoeba and euglena exhibit binary fission.

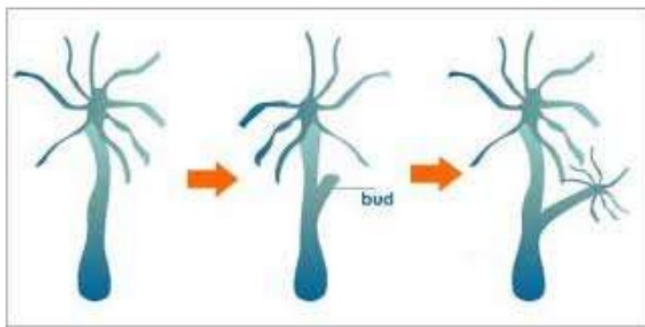
It is one of the simplest and uncomplicated methods of asexual reproduction. The parent cell divides into two, each daughter cell carrying a nucleus of its own that is genetically identical

to the parent. The cytoplasm also divides leading to two equal-sized daughter cells. The process repeats itself and the daughter cells grow and further divide.

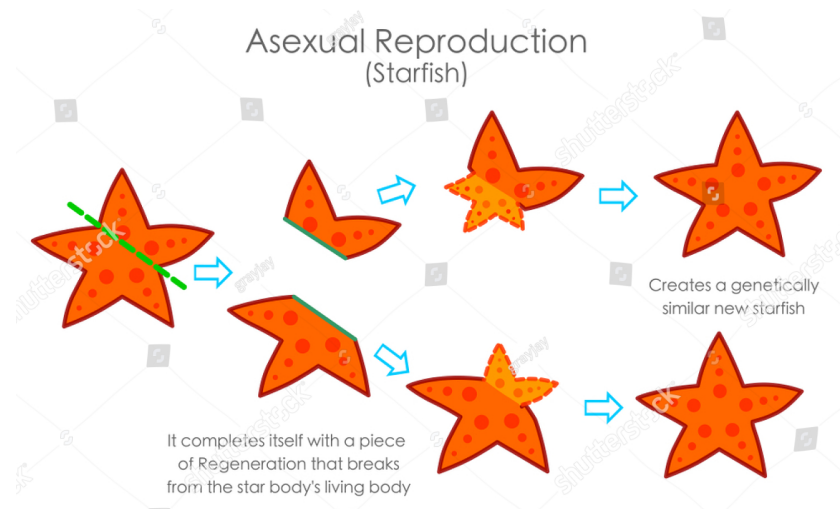
- Budding

Budding is the process of producing an individual through the buds that develop on the parent body. Hydra is an organism that reproduces by budding. The bud derives nutrition and shelter from the parent organism and detaches once it is fully grown.

### Budding of Hydra



- Fragmentation



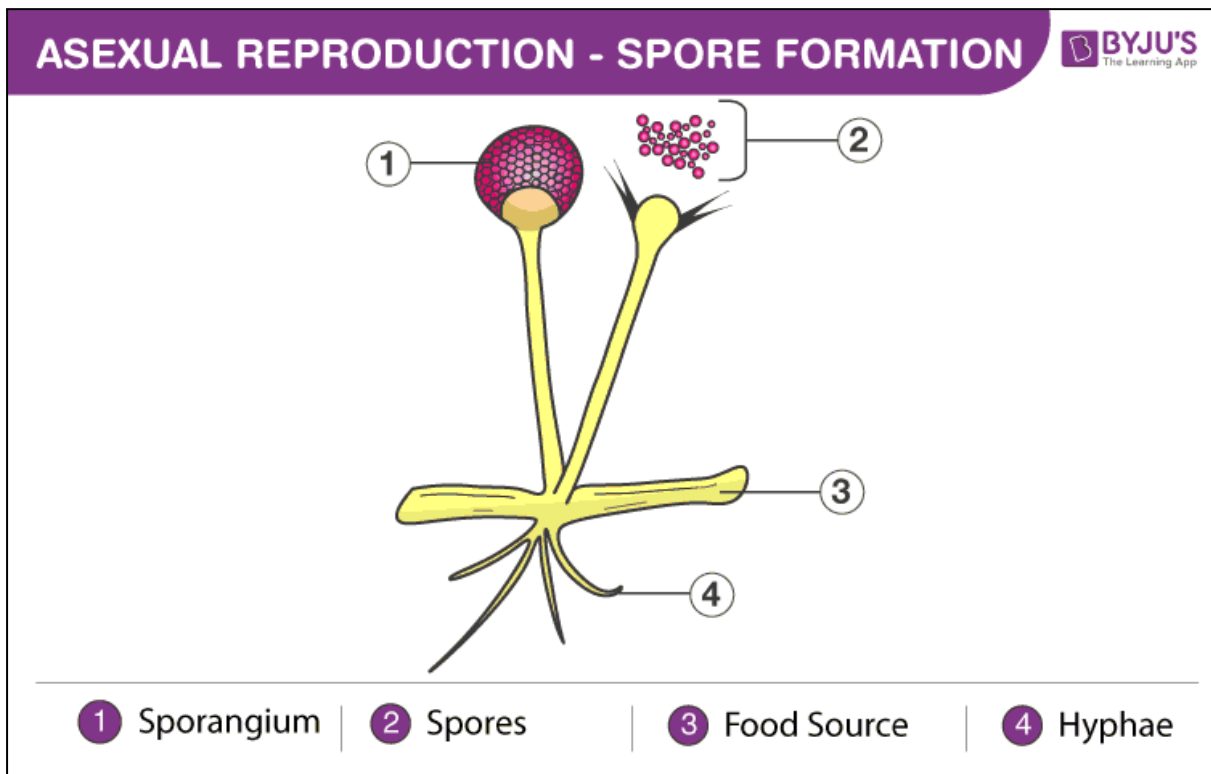
Fragmentation is another mode of asexual reproduction exhibited by organisms such as spirogyra, planaria, etc. The parent body divides into several fragments and each fragment develops into a new organism.

- Vegetative Propagation

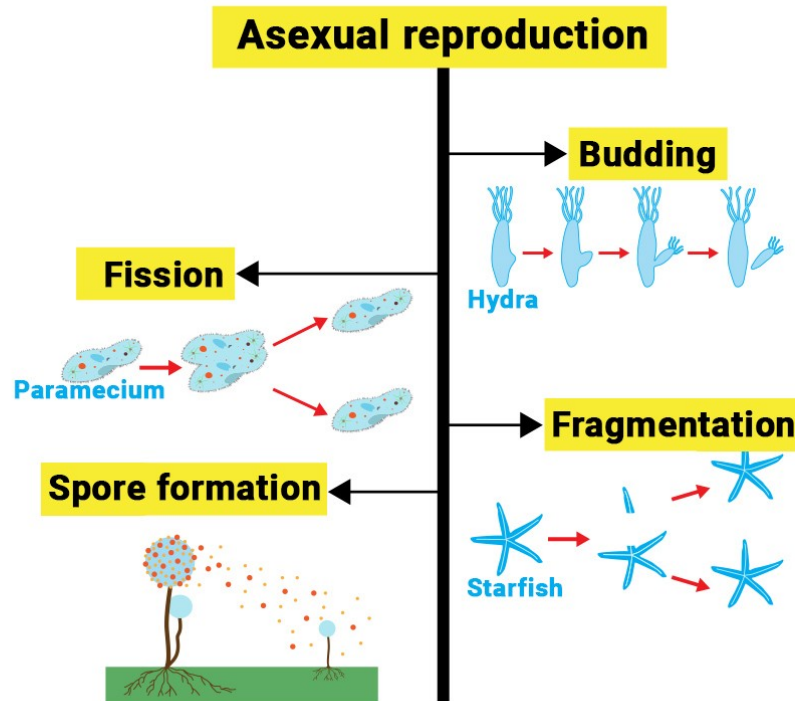
Asexual reproduction in plants occurs through their vegetative parts such as leaves, roots, stems, and buds. This is called vegetative propagation. For example, potato tubers, runners/stolons, onion bulbs, etc., all reproduce through vegetative propagation.

- Sporogenesis

Spore formation is another means of asexual reproduction. During unfavourable conditions, the organism develops sac-like structures called sporangium that contain spores. When the conditions are favourable, the sporangium burst opens and spores are released that germinate to give rise to new organisms.



In asexual reproduction, a single cell is divided to produce offspring. The simple cell-by-cell division is not possible in multicellular organisms. Most multicellular organisms have complex body designs. They have a higher level of organization like tissues, organs and organ systems. Thus, they need a special mode for reproduction.



## Advantages of Asexual Reproduction

The following are the advantages of asexual reproduction:

- Mates are not required.
- The process of reproduction is rapid.
- An enormous number of organisms can be produced in significantly less time.
- Positive genetic influences pass on to successive generations.
- It occurs in various environments.

# Disadvantages of Asexual Reproduction

The major disadvantages of asexual reproduction are:

- Lack of diversity. Since the offsprings are genetically identical to the parent they are more susceptible to the same diseases and nutrient deficiencies as the parent. All the negative mutations persist for generations.
- Since only one organism is involved, the diversity among the organisms is limited.
- They are unable to adapt to the changing environment.
- A single change in the environment would eliminate the entire species.

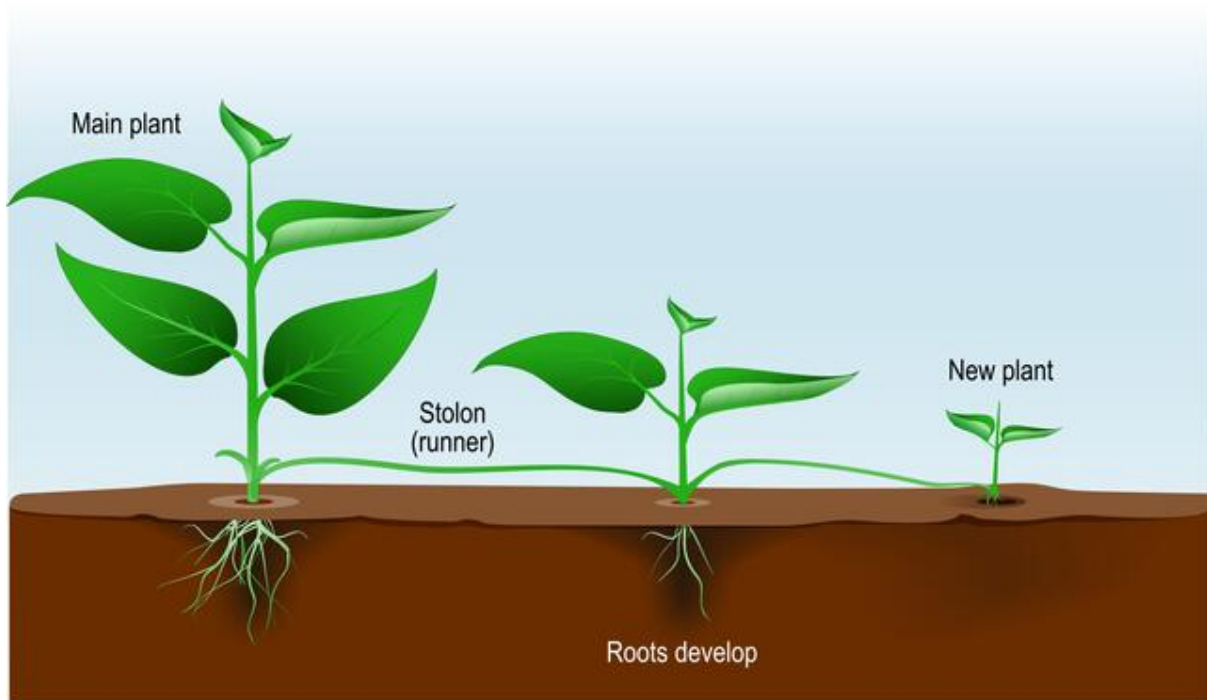
## Asexual Reproduction Examples

Following are the examples of asexual reproduction:

- Bacterium undergoes binary fission in which the cell divides into two along with the nucleus.
- Blackworms or mudworms reproduce through fragmentation.
- Hydras reproduce through budding.
- Organisms such as copperheads undergo parthenogenesis.
- Sugarcane can be grown Asexual reproduction only requires DNA from one parent. It creates offspring that are genetically identical to the parent. Genetically identical offspring are called clones. Clones lack genetic diversity. This makes them more susceptible to disease. It also makes them less adaptable to changes in the environment.

# Asexual Reproduction in Plants

## Vegetative reproduction



There are different methods of asexual reproduction. They include vegetative propagation and fragmentation.

Vegetative propagation does not require seeds or spores. Instead, offspring grow from a part of the parent plant. In different plants, vegetative propagation happens in different ways. Here are a few examples.

- Garlic, onions and tulip plants all reproduce using true bulbs. These short underground stems are also called scaly bulbs. They have a basal plate that is usually surrounded by modified leaves. These leaves form a papery covering called a tunic. New bulbs grow off of the parent bulb's basal plate.



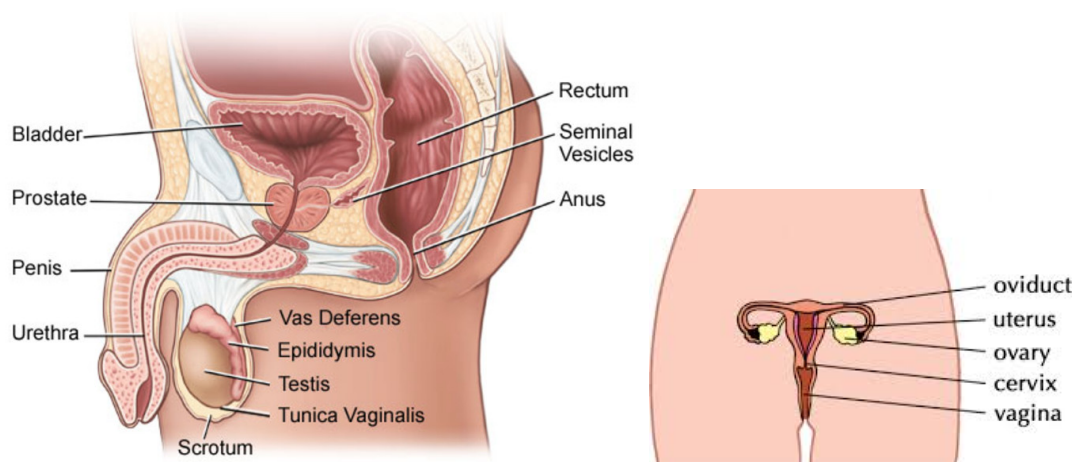
- Crocuses reproduce using corms, which are similar to true bulbs. However, a corm doesn't have as many layers. Corms are used up during the growing season and get replaced by one or more new corms.
- Potato plants reproduce using tubers. These underground growths produce new plants from stems or growing points called eyes.
- Ginger plants reproduce using rhizomes. These stems grow sideways along the soil or just below the surface. They branch apart to produce new points of growth.
- Strawberry plants reproduce using stolons. They look like branches growing along the ground. Stolons anchor themselves to the ground and develop roots. And these roots grow into new plants.
- through vegetative propagation.

## Sexual Reproduction

Sexual Reproduction is the production of new organisms by the combination of genetic information of two individuals of different sexes. In most species, the genetic information is carried on chromosomes in the nucleus of reproductive cells called gametes, which then fuse to form a diploid zygote. The zygote develops into a new individual. Sexual reproduction is the dominant form of reproduction in living beings.

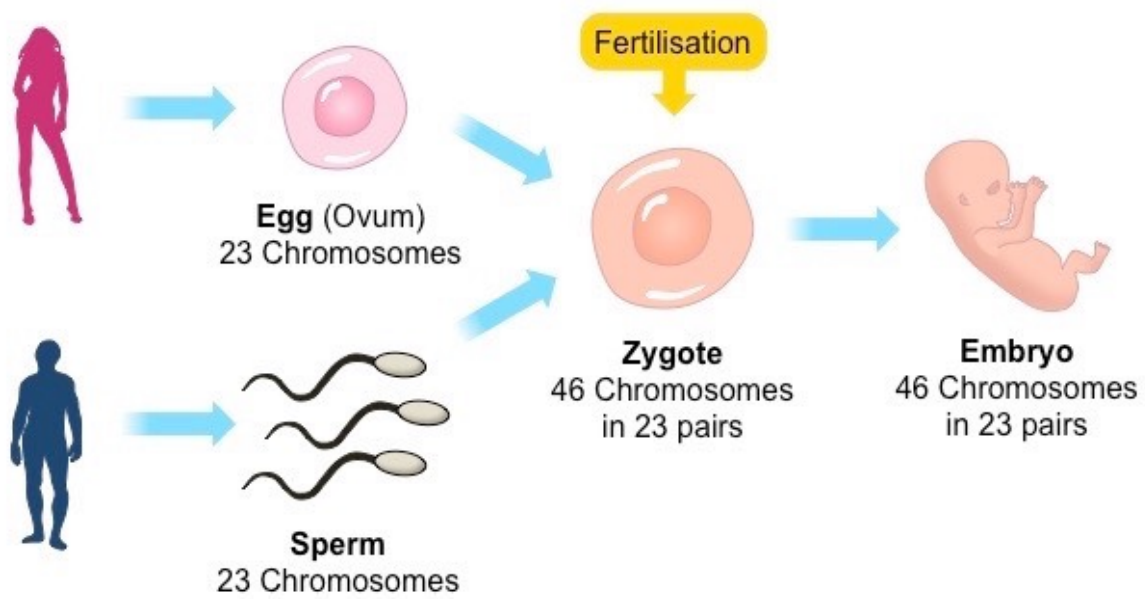
Sexual reproduction allows for the reshuffling of genetic material, both within and between individuals of one generation, resulting in the potential for an extraordinary array of offspring, each with a genetic makeup different from that of its parents. In the sexual reproduction of all organisms except bacteria, there is one common feature: haploid, uninucleate gametes are produced that join in fertilization to form a diploid, uninucleate zygote. At some later stage in the life history of the organism, the chromosome number is again reduced by meiosis to form the next generation of gametes. The gametes may be equal

in size (isogamy), or one may be slightly larger than the other (anisogamy); the majority of forms have a large egg and a minute sperm (oogamy). The sperm are usually motile and the egg passive, except in higher plants, in which the sperm nuclei are carried in pollen grains that attach to the stigma (a female structure) of the flower and send out germ tubes that grow down to the egg nucleus in the ovary. Some organisms, such as most flowering plants, earthworms, and tunicates, are bisexual (hermaphroditic, or monoecious)—i.e., both the male and female gametes are produced by the same individual. All other organisms, including some plants (e.g., holly and the ginkgo tree) and all vertebrates, are unisexual (dioecious): the male and female gametes are produced by separate individuals.

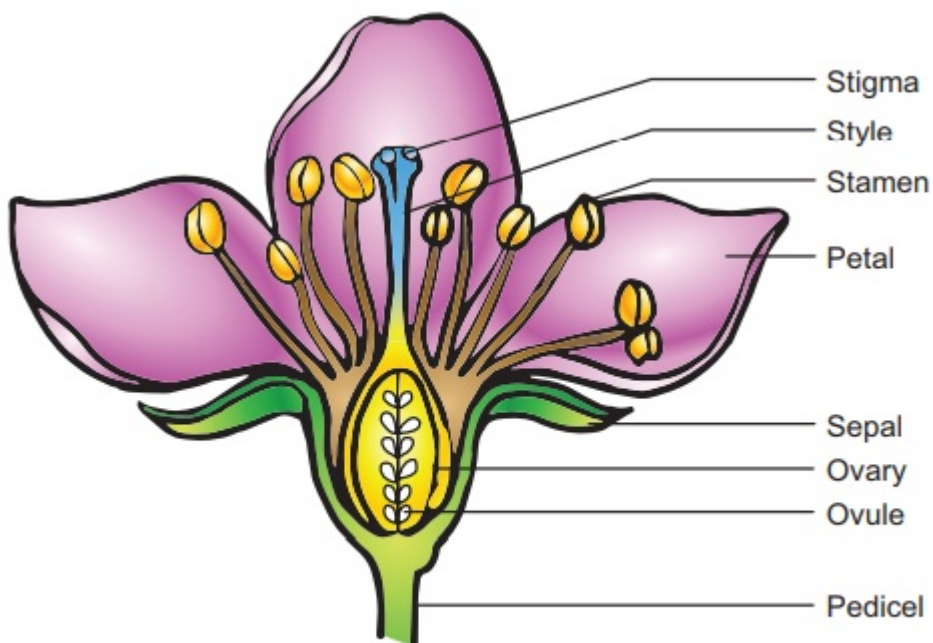


In animals, fertilization—that is, the uniting of the gametes—can be either internal or external. In external fertilization, the male releases sperm over eggs that have been released by a female. This form of fertilization is used by many invertebrates and by most fish and amphibians. In internal fertilization, the sperm unites with the egg within the body of an adult. In the vast majority of cases, fertilization takes place within the body of the female.

Sexual reproduction in plants also requires the uniting of male and female gametes. There is a much greater variety of structures and strategies used by plants. In general, flowers and cones are the locus of fertilization in plants.



Flowering plants reproduce sexually through a process called pollination. The flowers contain male sex organs called stamens and female sex organs called pistils. The anther is the part of the stamen that contains pollen. This pollen needs to be moved to a part of the pistil called the stigma.



**Figure 1.3** Parts of a Flower

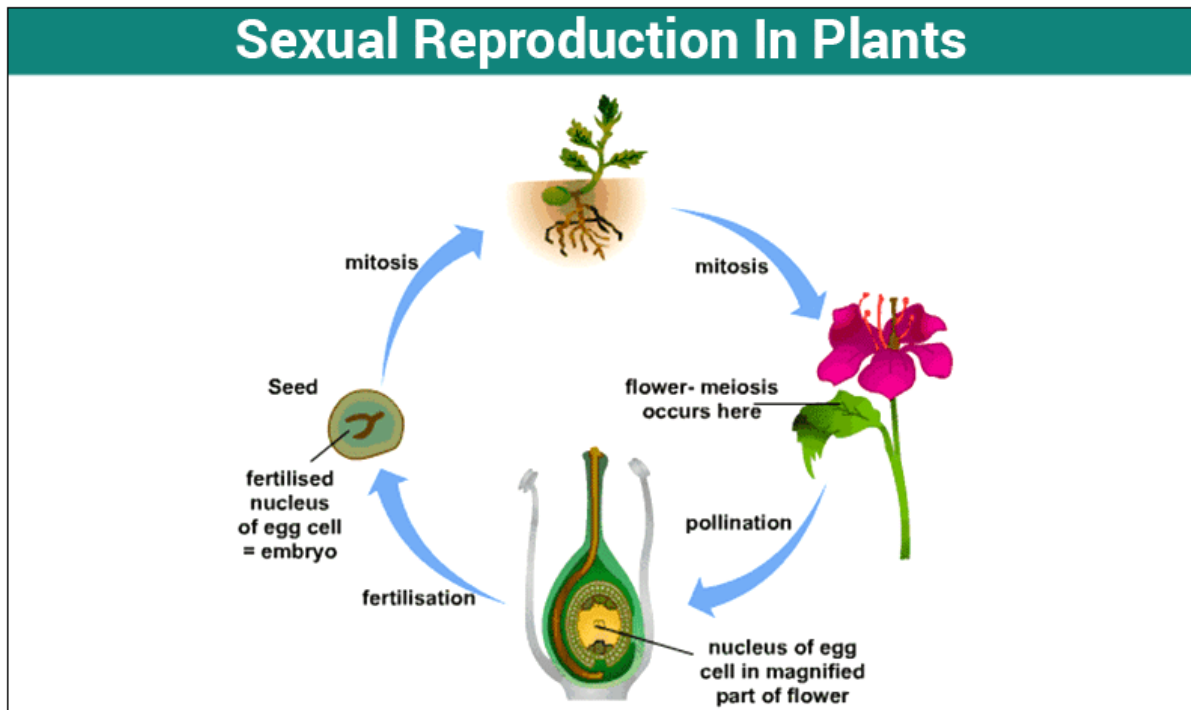
Plants can either self-pollinate or cross-pollinate. Self-pollination happens when a plant's own pollen fertilizes its own ovules. Cross-pollination happens when the wind or animals move pollen from one plant to fertilize the ovules on a different plant. The advantage of cross-pollination is that it promotes genetic diversity. Some plants have features that prevent self-pollination, such as pollen and ovules that develop at different times.

Pollinators are animals that carry pollen between plants. Many pollinators are insects, like bees, butterflies, moths and beetles. Some birds, including hummingbirds, also play a part. Likewise, certain mammals, like bats and rodents, move pollen between plants. The colours and smells of flowers often attract pollinators. Pollen will stick to a pollinator's body as it feeds on the flower's nectar.

Fertilization is the next step after pollination. Once it reaches the pistil, the pollen needs to fertilize an egg inside the stigma. This egg is called an ovule.

Fertilization creates fruits that contain seeds. Some fruits are fleshy, like oranges and watermelons. Others are dry, like acorns or walnuts. These fruits are an attractive food for various animals. After digesting fruit, animals expel waste that contains seeds. This way,

seeds can take root and grow in places far from the plants that produced them!



Human beings cannot reproduce asexually. They produce gametes which bring about sexual reproduction.

**ACTIVITY 1: Complete the following**

**1. What is Asexual Reproduction?**

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**2. Why can't humans reproduce asexually?**

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**3. How can a flowering plant pollinate?**

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**4. Name two disadvantages of Asexual reproduction.**

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**5. What is reproduction, in your own words?**

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**6. What is binary fission?**

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**7. What do ginger plants use to reproduce?**

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**8. Name two differences between asexual reproduction and sexual reproduction.**

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**9. What happens when a plant cross-pollinates?**

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**10. Explain an example of asexual reproduction.**

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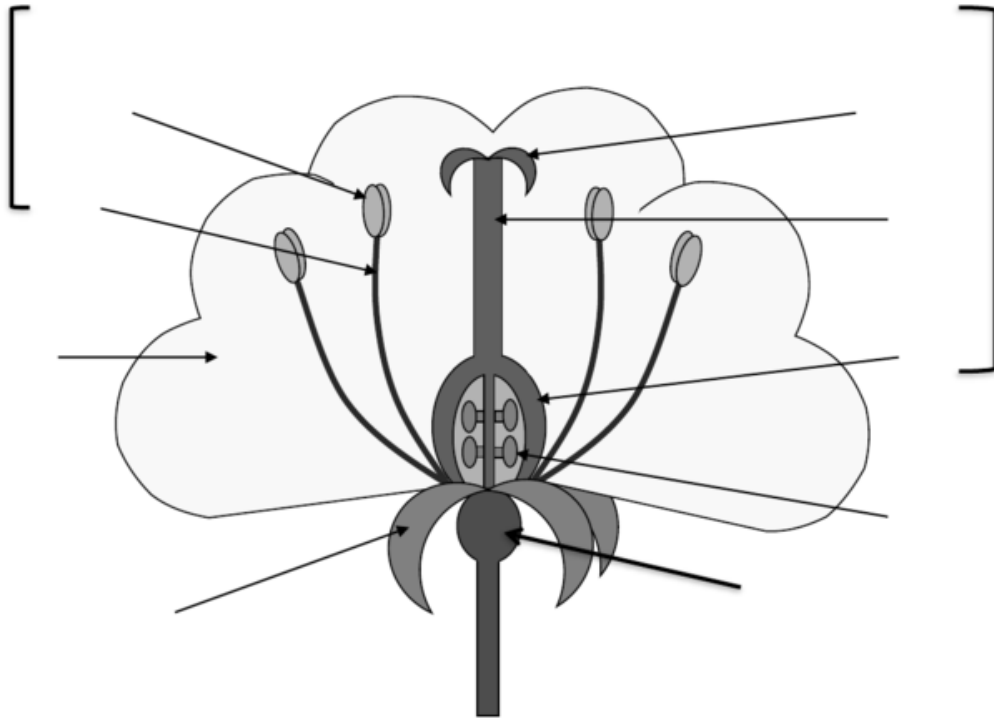
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## ACTIVITY 2:

### Sexual Reproduction in Plants

#### Structure of a Flower

Label the diagram below:



Complete the exercise below using the most appropriate word from the list below:

Carpel    Stamen    Stigma    Anther    Ovary    Ovule    Pollen  
Filament    Style

A word may be used more than once.

The male part of the flower called the \_\_\_\_\_ consists of the \_\_\_\_\_ and \_\_\_\_\_. The female part of the flower is called the \_\_\_\_\_ and consists of the \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_. The male gamete is made in the \_\_\_\_\_ and is found inside the \_\_\_\_\_ grain. The female gamete is found in the \_\_\_\_\_ and is called an \_\_\_\_\_.

Match the flower part with its correct function; the first one has been done for you.

Sexual Reproduction in Plants

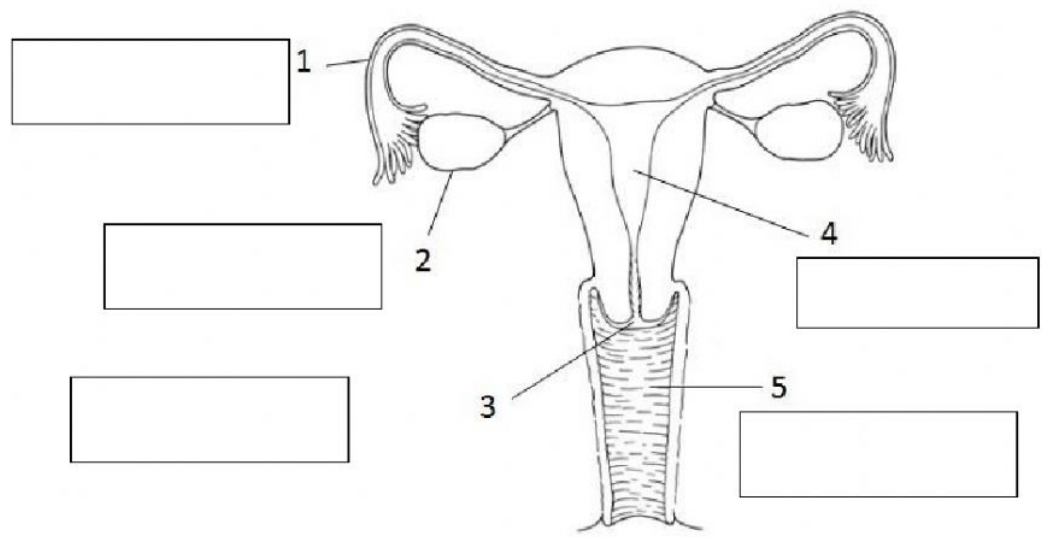
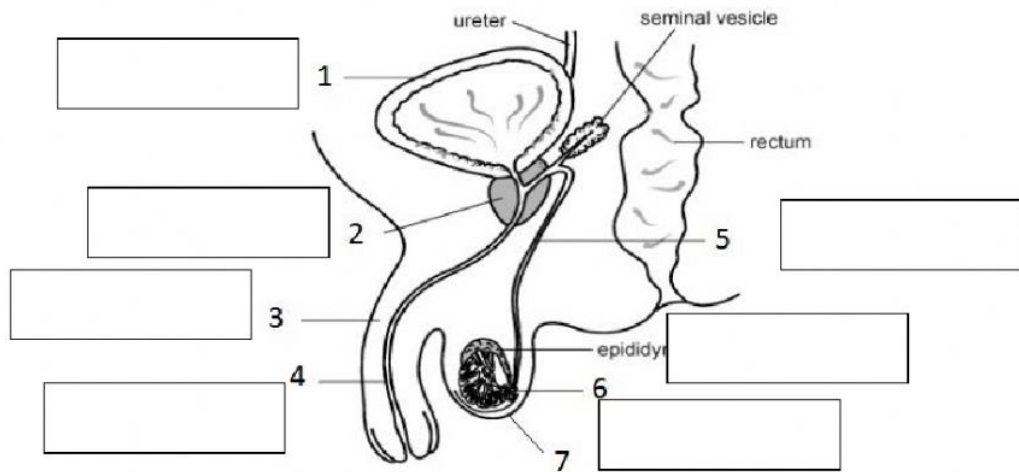
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**ACTIVITY 3:**

Name.....

1- Label the picture



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