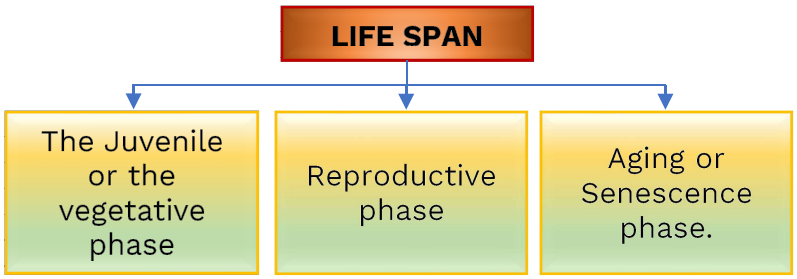
Reproduction in Organisms

Every organism on this Earth has a biological role to cater to. They reproduce, grow, develop and become physiologically mature to give birth to new individuals.

Lifespan of an organism is the time period from the birth to natural death.
In the lifespan, the organisms undergo many changes. Lifespan of an individual organism depends upon its external features, morphology and its internal organization. The lifespan of an individual may vary from a day (that is of mayfly) to many hundreds of years (like in case of certain trees).
The life span of an organism has been divided into three major phases.

Definition

Lifespan: The time period from the birth to natural death of an organism is called as lifespan.



The Juvenile or the Vegetative Phase

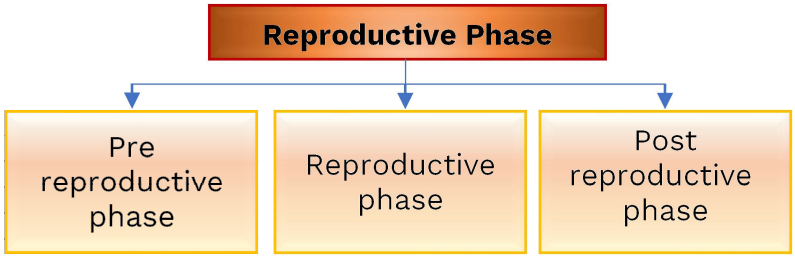
- It is the first phase in which an organism grows, develops and moves towards reproductive maturity.
- This phase has been said to be the vegetative phase in the plants in which the stem grows in height, develops leaves and moves towards vegetative maturity.
- In animals, during juvenile phase the organisms grow, develop and proceed towards reproductive maturity.

Definition

Reproduction: Reproduction is defined as a biological process in which the organisms give birth to young ones of their own kind.

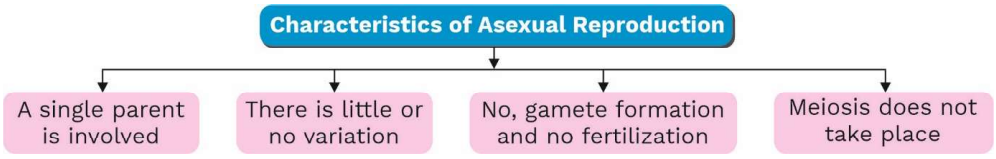
Reproductive Phase

- The organisms reproduce and give birth to young ones.
- Reproduction is defined as the biological process in which the organisms give birth to young ones of their own kind.



- Reproduction is of two types
  - Asexual reproduction
  - Sexual reproduction

Asexual Reproduction



Since, the young ones or the offsprings formed in asexual reproduction are morphologically and genetically similar to the parents, they are also known as clones.

Definition

Clones: Offsprings morphologically and genetically similar to the parents.

Advantages of Asexual Reproduction:

- It is a quick and easy process which does not take energy.
- There is little or no variation and thus we can conserve the characteristics that we want in the animals or plants.
- A large number of offsprings can be produced by a single parent.

Disadvantages of Asexual Reproduction:

- If there is any defect in the parent, it is passed onto the offspring.
- Since it does not produce any variations or very few variations, the survival of an individual organism in unfavorable conditions or changing conditions becomes difficult. Variation helps in changing the body design and thus helps an organism to adapt to the changing environment. But if variation is not taking place then it affects the organism, as it may not adapt or survive in the changing environment.

Modes of Asexual Reproduction in Lower Organisms

Fission: It takes place in organisms in which parent cell divides to form daughter cells. It is of two types

- Binary fission
- Multiple fission

Binary Fission

- The parent cell divides to form two daughter cells. It takes place in favourable conditions.
  Example: *Amoeba, Euglena, Leishmania and Paramecium.*
  - In *Amoeba,* the plane of division is irregular.

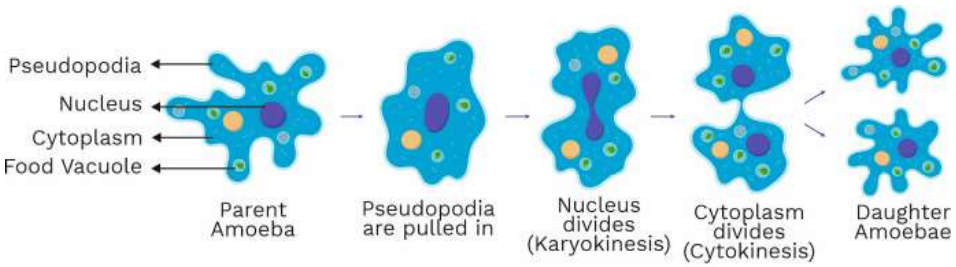


Fig: Binary Fission in Amoeba

  - In *Euglena* and *Leishmania,* the plane of division is longitudinal.

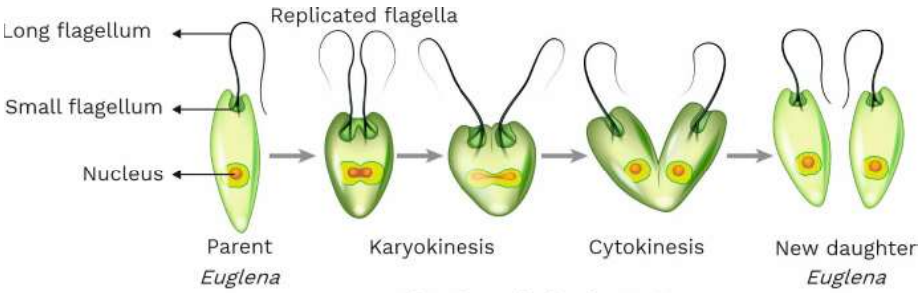


Fig: Binary fission in *Euglena*

Multiple fission

- In this, the parent cell divides to form many daughter cells. Fission takes place in favourable and unfavourable conditions.
  Example: *Plasmodium*

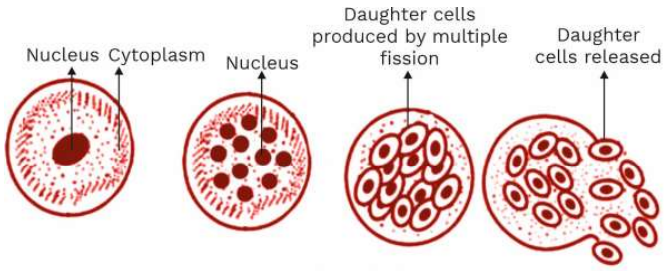


Fig: Multiple Fission in *Plasmodium*

Sporulation in *Amoeba*

- Under unfavourable conditions, *Amoeba* withdraws its pseudopodia and surrounds itself by three layers forming a cyst wall. This is known as encystation.
- On return of favourable conditions, the cytoplasm of amoeba divides by multiple fission forming minute amoebae called pseudopodiospores.
- The cyst ruptures and releases the pseudopodiospores that form new amoebae.

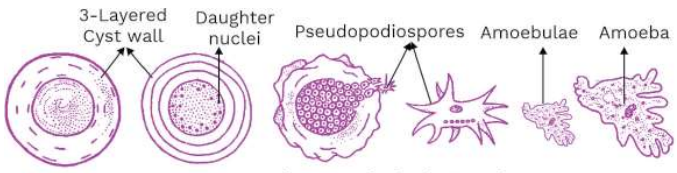


Fig : Sporulation in Amoeba

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Exception of concept of lifespan: In binary fission, the parent body acts as a reproductive unit and looses its identity when daughter cells are formed. Thus, parent cannot be said to have died. So, the parent is immortal. Example: *Amoeba*

Budding

- An outgrowth from the parent body develops which slowly grows, matures, becomes a new individual and eventually separates from the parent body.
  Example: *Hydra* and *Yeast*.

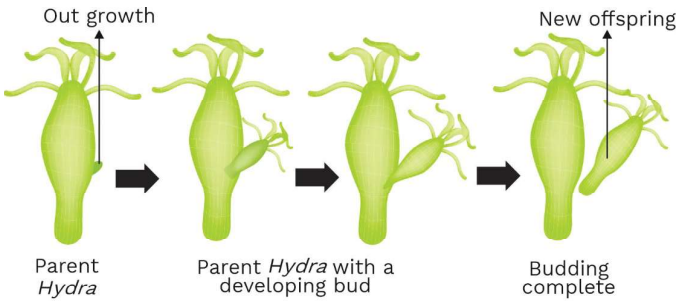

Fig: Budding in *Hydra*

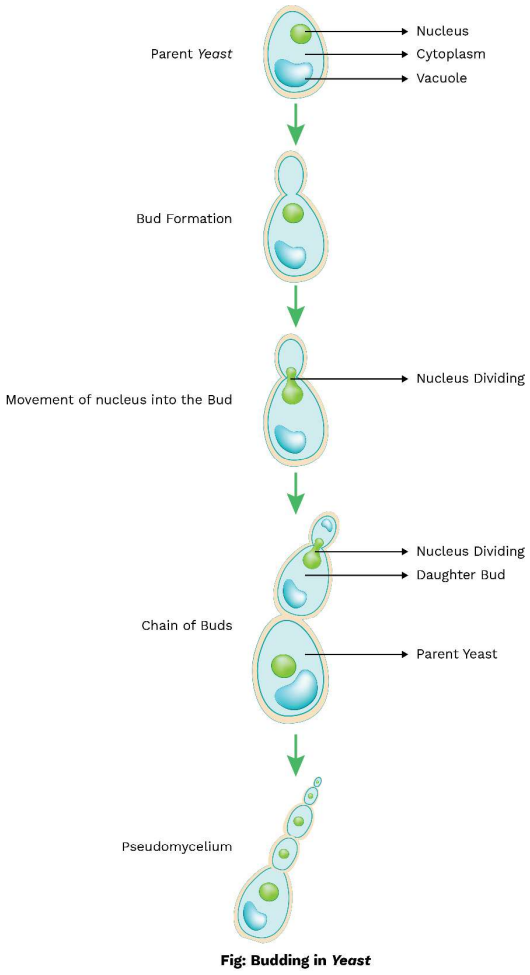

Fig: Budding in *Yeast*

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Torula stage: During budding, yeast may bear many daughter buds in a chain like fashion. Such condition is known as torula stage. *Torula* is a yeast like fungus composed of chains of rounded cells.

Fragmentation

- The parent body breaks into two or more than two pieces called fragments.
- Each of the fragment is capable of developing into a new individual.
  Example:
  - Algae - *Spirogyra*
  - Fungi - *Rhizopus*
  - Bryophyte - *Marchantia, Riccia*

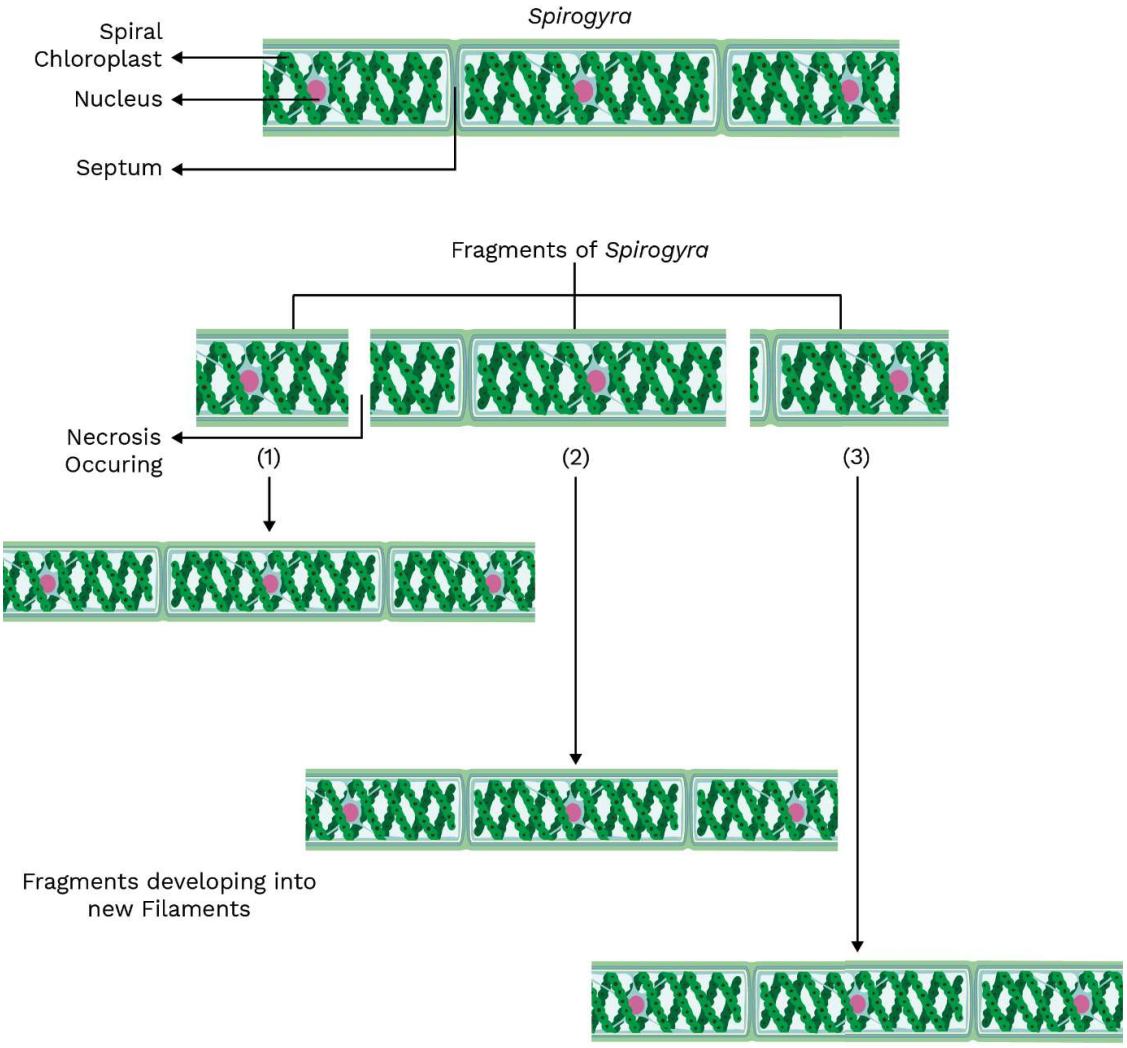

Fig: Fragmentation in *Spirogyra*

Regeneration

- If the body of an organism cuts into parts or is injured, each part has the capability to regenerate the whole organism.
- This type of regeneration is known as morphallaxis. Examples: *Planaria, Hydra*

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Epimorphosis: The replacement of the lost body parts. It is a type of regeneration.
It is not a mode of asexual reproduction.
Example: Formation of a new tail in lizard

Asexual Reproductive Units in Lower Organisms

Conidia

- In certain fungi, spores (known as conidia) develop on structures called as conidiophores.
- Conidia are thick-walled spores.

  Example: *Penicillium*

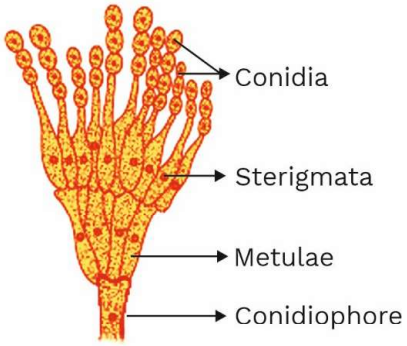


Fig: Conidia in *Penicillium*

Rack your Brain

What is the morphological difference between pseudopodiospores and conidia?

Zoospores

- In algae, asexually formed spores are known as zoospores.
- These spores are
  - motile
  - biflagellate
  - haploid or diploid depending upon the ploidy of the parent.

  Example: *Chlamydomonas*

Rack your Brain

Name the organisms that form buds endogenously and exogenously.

Gemmules

- In the sponges, archaeocytes form gemmules during favourable conditions.
- Gemmules move out to the body of the sponge and form new colonies.

  Example: *Sycon*

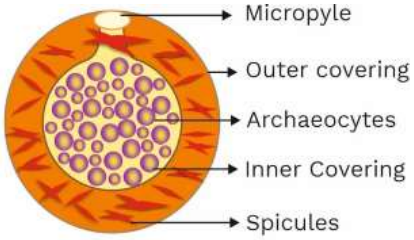
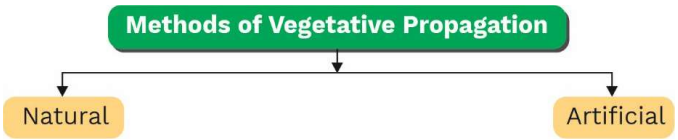


Fig: Gemmules in Sponges

Vegetative Propagation

- Asexual reproduction in plants is also referred to as vegetative propagation. In this, a new plant is formed from the vegetative unit or also called as vegetative propagule. These propagules could be the stem, the leaf, or the root.



Natural Methods of Vegetative Propagation

Tuberous root

- Fleshy roots or tubers develop adventitious buds which help in vegetative propagation.
  Examples: Sweet Potato, Dahlia

Tubers

- These are underground modifications of the stem.
- Buds are present on their nodes, these buds produce new plantlets.
  Example: Potato

Fig: Tuber in Potato

Bulb

- It is also an underground stem modification which has one or more buds, and these buds are able to give rise to new plant.
- Stem is discoidal.
- Leaves storing food arise from the stem and enclose the developing apical bud.
  Examples: Onion, garlic.

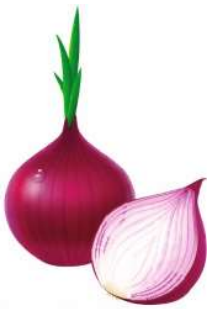


Fig: Bulb of Onion

Corms

- These are unbranched swollen underground stem. These buds have the ability to give rise to a new plant.
  Example: *Colocasia*

Rhizome

- It's an underground stem which has axillary buds.
- These buds help in formation of new shoot during favorable conditions.
  Examples: Ginger, Turmeric, Banana

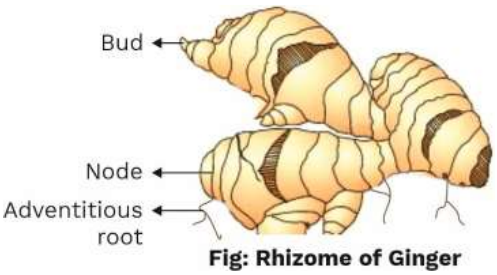


Fig: Rhizome of Ginger

Bulbils

- Fleshy buds which help in propagation.
- Bulbil is a modified floral bud that develops on the floral axis and germinates attached to it.
  Example: *Agave*

Leaves

- Adventitious buds are present in the notches of the leaf.
- These buds develop into new plantlets which when falling on the ground develop into new plants.
  Example: *Bryophyllum*

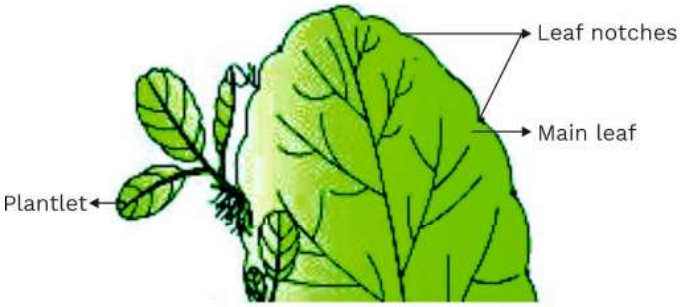


Fig: *Bryophyllum*

Suckers

- These are long, thin underground branches.
- They develop at the base of the aerial shoot.
- They grow for some distance and form a new aerial shoot.
  Example: Mint, *Chrysanthemum*

Runners

- These are green horizontal branches which develop at the base of the shoot.
- These branches grow for some time and again from the crown.
  Example: Lawn grass, *Oxalis*

Stolon

- These are arched horizontal branches that develop at the base of the shoot.

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In *Bignonia*, injured leaf develops into a new plant, when it falls on the ground.

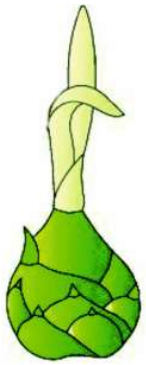


Fig: Bulbil of *Agave*

Example: Strawberry

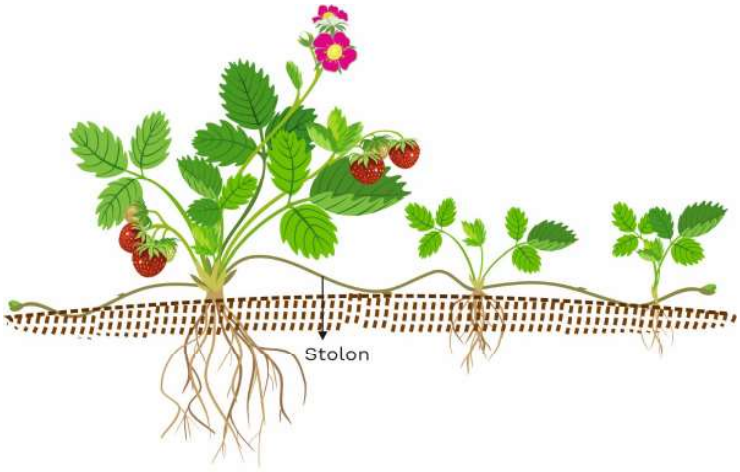


Fig: Stolon of Strawberry

Offset

- Horizontal branches that occur in some aquatic plants.
- They grow for some time and then give off new shoot.
  Example. *Eichhornia* (Water hyacinth)
  - Water Hyacinth grows and spreads quickly. It was introduced in India because of its beautiful flowers and leaves. It is known as the 'Terror of Bengal' because it has spread over the water bodies and cuts the light. Due to this, the circulation of oxygen is not adequate and as a result, the aquatic life ends.

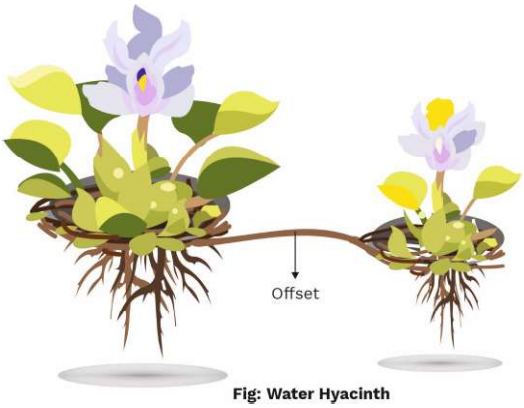


Fig: Water Hyacinth

Artificial Methods of Vegetative Propagation

Cutting

- Part of the stem, root or leaves can be cut and planted which after a few days would lead to the formation of a new plant.
  Example
  - Root cutting -Lemon, orange.
  - Stem cutting - Rose, Sugarcane.
  - Leaf cutting - Snake plant.

Layering

- Roots are induced to develop on a soft long stem which is still attached to the plant.
- A long twig is selected and at regular intervals, it is put into the soil and kept for many days. Adventitious roots develop from the part of the stem which has been buried in the soil.
- Once the roots have been formed from the stem, it can be cut at different places and hence, new plants will be formed.

Examples: *Jasmine*, grapevine

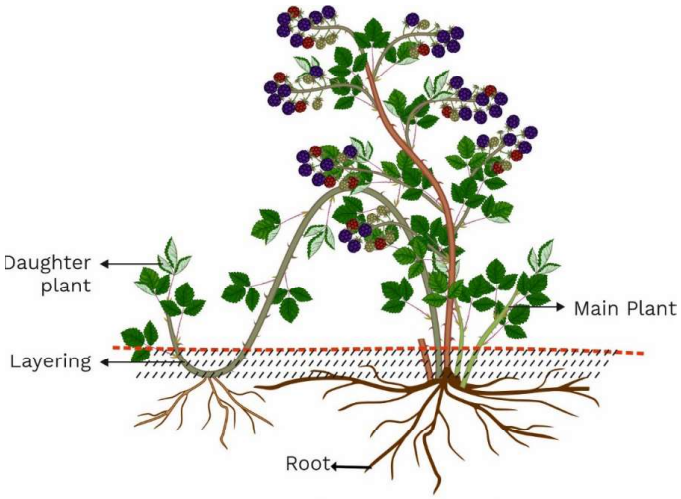


Fig: Layering in a Plant

Grafting

- It is a technique in which two plants of good desirable characteristics are connected together.
- Usually, the root system and the shoot system of different plants are united to develop into a new combined plant. The shoot of the plant with the desired superior characteristics is called as a scion. A scion should have at least a few buds. The roots system is known as a stock.
- Scion with desired characteristics is cut and is placed on another plant root system which has other superior characteristic features.

Rack your Brain

Which hormone initiates rooting in the process of layering?

Rack your Brain

Which category of plant cannot be grafted?

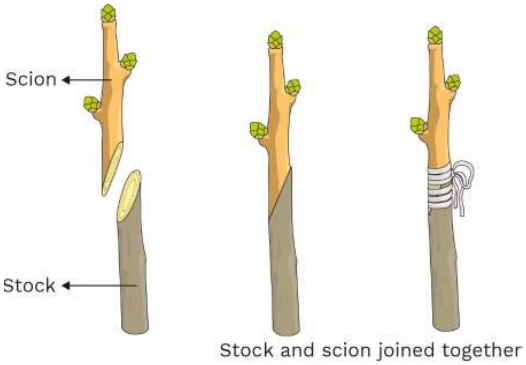


Fig: Grafting

- The point of contact between both the stock and the scion is bandaged.
- Before bandaging some amount of soil with nutrients are placed on the point of contact.
- The stock and the scion are joined with each other for a span of few days or months depending upon the type of plant chosen.
  Examples: Apple, mango, guava, peach

Advantages of Vegetative Propagation

- Quick and easy process.
- Can help in multiplication of plants without seeds or seedless plants. Example -Sugarcane, Banana.
- The superior characteristics of the plant can be retained.
- Within a short span of time, a large number of plants can be obtained.
- Disease-free plantlets can be obtained.

Disadvantages of Vegetative Propagation

- Propagules are easily affected by pathogens, temperatures and climatic changes.
- There is no variation and thus, the plant may not be able to adapt to the changing environment.

Micropropagation or Plant Tissue Culture

- In this method, cells are taken from the different plant tissues like the anther, ovary, tip of the plant and cultured in laboratory conditions.
- A group of cells are taken and placed in a petri dish with the nutrient medium.
- These groups of cells divide continuously and form a mass of cell known as callus.
- This callus is now transferred to a petri dish containing phytohormones like Auxins, Gibberellins and Cytokinin.

Rack your Brain

Which disadvantage of asexual reproduction is an advantage in micropropagation?

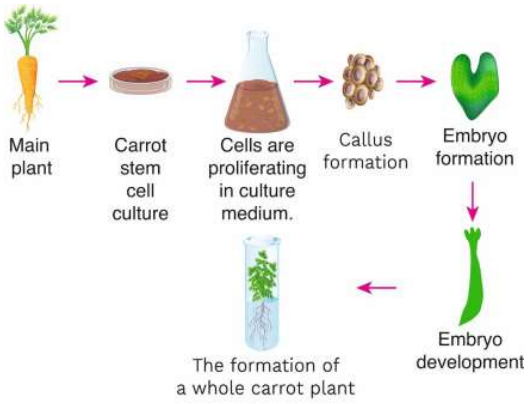
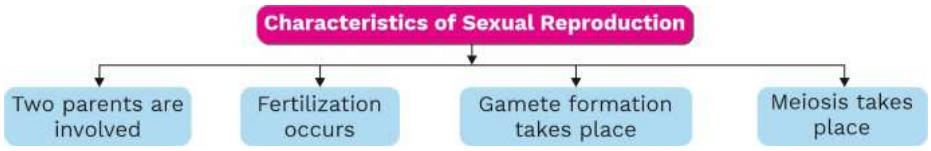


Fig: Micropropagation in Plants

- Within a few weeks, a new plantlet develops. From the laboratory, then these plantlets are transferred to the field.
  Examples: Rubber, pineapple

Sexual Reproduction



Advantages of Sexual Reproduction

- Variation occurs, as a result of which the organisms body design changes with the change in the habitat or niche. This helps in the survival of the organism in harsh climatic conditions.
- Sexual reproduction also helps in evolution of organisms and thus, ensures continuity of species.

Disadvantages of Sexual Reproduction

- It takes a lot of time and energy.
- A large number of organisms cannot be formed in a short span of time.
- Fertilization is a chance factor.

All the organisms can be divided into different categories on the basis of the sexual organs present.

- **Homothallic (bisexual condition):** In primitive organisms like certain fungi, there are no morphological or physiological differences in the functional gametes. The gametes belong to the same plant, and such a condition is known as homothallic.
  Example: *Mucor*
- **Heterothallic (unisexual condition):** In some other fungi, the functional gametes belong to two different parents, but there is no morphological and physiological difference. Then these

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Out of Asexual and Sexual reproduction, which is a better mode and why?

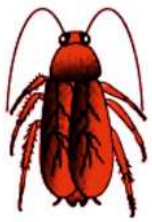

Fig: Cockroach (Unisexual)

Definition

Monoecious plant: A monoecious plant has both unisexual and bisexual flowers.

organisms are called as heterothallic.
Example: *Rhizopus stolonifer*

- **Unisexual:** In higher organisms and in plants well-differentiated male and female organisms are present. Such organisms are unisexual. Some lower organisms also show sexual dimorphism like cockroach.
  Examples: Human, reptiles etc.
  - **Staminate flowers:** In some flowering plants, only male reproductive parts are present, such flowers are known as staminate flowers and the plant is known as dioecious plant.
    Examples: Date palm, papaya, coconut
  - **Pistillate flowers:** Similarly, in some flowering plants only female flowers are present such flowers are known as pistillate flowers and such a plant is known as dioecious plant.
    Examples: Date palm, papaya
- **Bisexual:** In some flowering plants if both the male and the female sex organs, i.e. the stamen and carpel are present in the same flower then the flower is bisexual and such a plant is said to be monoecious.
  Examples: Sweet potato, *Hibiscus*
- In some animals, male and the female sex organs are present in the same individuals. Such animals are called as hermaphrodites.
  Examples: Leech, earthworm

Definition

Dioecious plant: Separate male and female flowers are found in different plants.

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Neutral flower: A flower which has neither androecium nor gynoecium.
Examples: Sunflower and cucumber

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Self-fertilization in animals: Hermaphrodite organisms can show self-fertilization.
Example: Tape worm

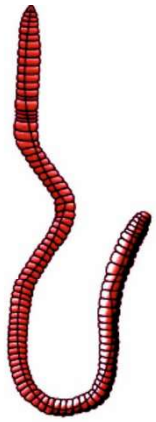
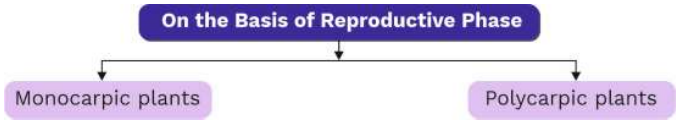


Fig: Earthworm (Hermaphrodite)



Monocarpic plants: These plants flower only once in their lifetime. They produce seeds, fruits and then they die.

Examples -Wheat, Rice, Carrot, Radish

- There are other plants which only flower once in their whole lifetime, for example, certain bamboo species.
- Another plant i.e, *Strobilanthes kunthiana* commonly known as Neelakurinji flowers once in every twelve years. It flowered in September, October 2006, and later in 2018. It is found in the hilly areas of Kerala, Karnataka and Tamil Nadu. It has beautiful, blue coloured flowers.

Rack your Brain

Certain papaya plants never bear fruits. Why?

Polycarpic plants:

- These are usually perennial plants which flower repeatedly at regular intervals, every year.
  Examples: Apple, mango
- Another group of perennial plants have flowers throughout the year like *Hibiscus*.

Breeding in animals:

- For animals, the breeding is either seasonal or they are continuous breeders.

Seasonal breeders

- These reproduce at a particular period of the year.
  Examples: Frog, lizards

Continuous breeders

- They continue to breed in their sexually mature period.
  Examples: Rabbit, mice, cattle
- In case of mammals, there are certain cyclic changes that take place in the ovary during the reproductive phase and on the basis of this, there are two types of cycles:

Oestrous cycle

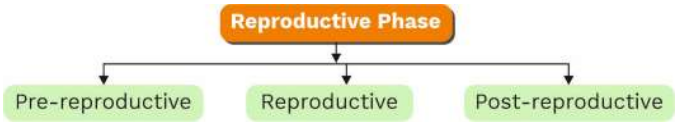
- It occurs in the non primates.
- Intercourse only during a specific period of time in their reproductive phase.
- There is no shedding up off the endometrium lining. It is reabsorbed.
- Depending upon the number of Oestrous cycles experienced in a year, the females can be Monoestrous, biestrous or polyestrous.
  Examples:

- Monoestrous (one estrous cycle in a year) – Deer
- Biestrous (two estrous cycles in a year) – Dog
- Polyestrous (many estrous cycles in a year) – Mouse, ground squirrel

Menstrual cycle

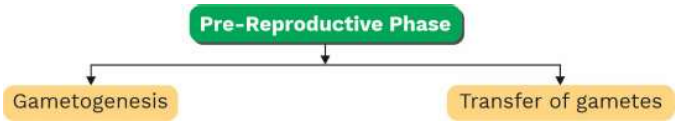
- It occurs in the primates.
- There are cyclic changes in the organism, after they reach the age of puberty.
- Shedding off the inner lining i.e., endometrium of the uterus occurs every month.
- The passage of the Endometrium lining along with the unfertilized egg out of the body is known as menstruation.

Examples: *Gorilla*, monkey



Pre-Reproductive Phase

- Pre reproductive phase has been divided into two events-Gametogenesis and Transfer of gametes.



Gametogenesis

- The organisms need to produce male and female gametes for the reproductive phase.
- Gamete means *'gametos'* = gamete, *'genesis'* = production i.e. the formation of the gametes. The process of formation of gametes is known as Gametogenesis.
- Gametes are usually haploid cells.
- They can be classified as following:

Homogamete or isogamy

- It is the fusion of two gametes which are similar in appearance and they cannot be differentiated into male and female gametes.

Example: *Cladophora*

Anisogamy

- It is the fusion of two gametes where one of the gametes is large and the other one is small. Thus, there is a distinction between the two gametes morphologically.
- The smaller gamete is the male gamete while the larger gamete is the female gamete.

Example: *Polysiphonia*

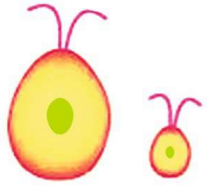


Fig: Anisogametes

Heterogametes

- In these organisms, the male gamete and the female gametes are structurally different from each other. The male gamete is known as antherozoid or sperm, and the female gamete is known as egg or ovum.

Examples: Humans, *Fucus*

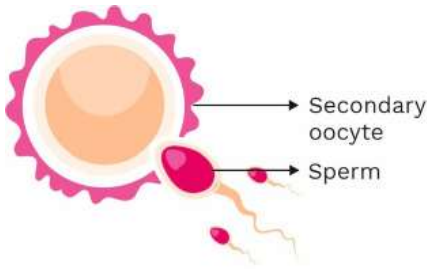


Fig: Heterogametes

Oogamy

- The fusion of a large motile female gamete and small motile male gamete takes place.
  Example: *Volvox*

Cell division during gamete formation

- The gametes are formed from the germ cells, which are present in the reproductive organs.
- During the formation of the gametes, the chromosome number needs to be maintained in such a way that the offsprings born via sexual reproduction would have the same chromosome number as the parent.
- Gametes are usually formed by meiosis.
- The gamete-producing cells, or the gamete mother cells known as meiocytes undergo meiosis and produce gametes.
- Depending upon the stage at which meiosis occurs, there are following types of meiosis-

Gametic Meiosis

- In diploid organisms, when gametes are formed they undergo the process of meiosis as a result, the gametes formed are haploid and when these haploid gametes fuse together, they restore the ploidy in the offsprings. This is known as gametic meiosis, as the meiosis is taking place during gamete formation.
  Examples: Most animals

Zygotic Meiosis

- If the organism is haploid, the gametes formed would be through mitosis. The haploid gametes fuse together to form a diploid zygote. After this, meiosis would take place in the zygote, so that the individual thus, formed would be haploid as the parent. Such type of meiosis is zygotic meiosis as the meiosis is taking place in the zygote.
  Example: *Chlamydomonas*

Sporic Meiosis

- If the gametophyte is haploid, then gametes are formed by mitosis. The haploid gametes fuse together to form a diploid zygote. The diploid zygote leads to the formation of a diploid sporophytic body. Inside the sporophytic body, meiosis takes place for the formation of spores. As such a meiotic division results in the formation of haploid spores, this division is known as sporic meiosis.
  Example: Bryophytes

Transfer of Gametes

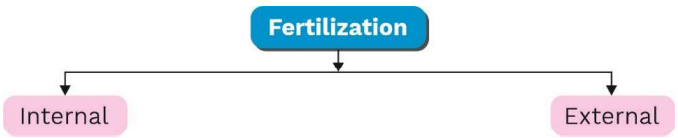
- Once the gametes have been formed, the next process is the transfer of gametes from the male parent to the female parent.
- A medium is needed through which the transfer can be made possible. In some organisms, the male gamete is motile and the female gamete is non-motile. In a

few fungi and algae, both the male and female gametes are motile. In angiosperm, the male gamete is motile while the female gamete is non-motile.

- In the algae and bryophytes, water acts as a medium through which the gamete transfer from one parent to another.
- Since, the gametes have to travel through the medium of water, a large number of gametes die or are wasted and thus, many gametes are being produced so as to increase the probability of at least some of them reaching the other gamete for fusion.
- In angiosperms the male gamete is carried from the anther of one flower to the stigma of the same flower or another flower, and this is known as pollination.
- In Angiosperms and Gymnosperms, agents of pollination are wind, water, insects, birds.
- In algae and bryophytes, the agent of pollination is usually water.
- Once the pollen grain lands on the stigma of the flower, pollen tube is formed which carries the two male gametes towards the ovules in the embryo sac.

Reproductive Phase

- In this phase, syngamy or fertilization takes place, during which the male gamete fuses with the female gamete and leads to the formation of a zygote.



Internal fertilization

- The fusion of the male and the female gamete takes place inside the female body. In this case, the developing embryo is well protected and the chances of its survival are very high.

Definition

Pollination: The transfer of pollen grains from the anther to the stigma of the same or different flower.

Rack your Brain

Which type of fertilization is an evolved feature and why?

Gray Matter Alert!!!

Parthenogenesis: It can be complete and incomplete.
Complete: There is no sexual phase and no males.
Example: Caucasian Rock Lizard
Incomplete: The sexual generation and parthenogenic generation both alternate with each other. The diploid eggs produce females, and the fertilised eggs produce males.
Example: Insects

Examples: Humans, reptiles, birds

External fertilization

- If the fusion of the male and the female gametes takes place outside the female body (in the surrounding environment), then it is known as external fertilization.
- In these organisms, large number of sperms are being produced because a large number of them are eaten up by animals or destroyed by the flow of the water.

  Examples: Fish, frogs

Parthenogenesis

- '*Parthenos*' = Virgin, '*Genesis*' = Produce
- In certain organisms, fertilization or syngamy does not take place and the formation of the offspring is without fertilization. This is known as parthenogenesis.
- It is seen in *Rotifers*, honeybee, turkey, lizards.

Advantages of Parthenogenesis.

- There is no variation and as a result, useful characteristics could be passed on to the offsprings.
- Offsprings are exactly similar to the parent.

Disadvantages of Parthenogenesis

- No new combination of characters and thus, no adaptability.
- Reduced chances of survival of the offsprings.

Post Fertilization Phase

- After fertilization, zygote is formed.
- Zygote is considered as a vital link for the formation of the next generation.
- Zygote which is a single-celled diploid structure divides by mitosis.
- Zygote becomes a multicellular structure known as the embryo.

- In fungi and algae, zygote develops a thick wall around itself to prevent desiccation and damage. The zygote undergoes a period of rest before germination.

Embryogenesis

- Embryogenesis means the process of development of embryo from the zygote. The zygote undergoes cell division by mitosis and then cell differentiation to form the embryo.
- Depending upon where the development of the zygote is taking place, organisms can be classified into: Oviparous or Viviparous.
    - **Oviparous:** Organisms in which the development of the young one takes place outside the body of the female. The organisms lay egg and after the period of incubation, the young one hatches and further develops into adult.
      Examples: Birds, fish, frogs
    - **Viviparous:** Organisms where the development of the young one takes place inside the body of the female. The offsprings are protected and have higher chances of survival.

  Examples: Mammals
- In flowering plants, the zygote is formed inside the ovule in the ovary.
- The fertilized ovule develops into seed and the ovary develops into fruit.
- The ovary wall develops into the pericarp i.e. the wall of the fruit.
- After fertilization, the sepals and petals shrivel and fall off. The stigma, style, anther and filament also shrivel and fall off.
- After dispersal, the seed germinates to form new plant.

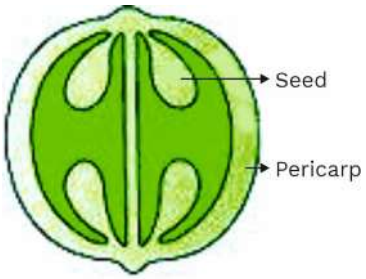


Fig: A Section of Fruit

Rack your Brain

Name the plants that have persistent calyx in their fruit.

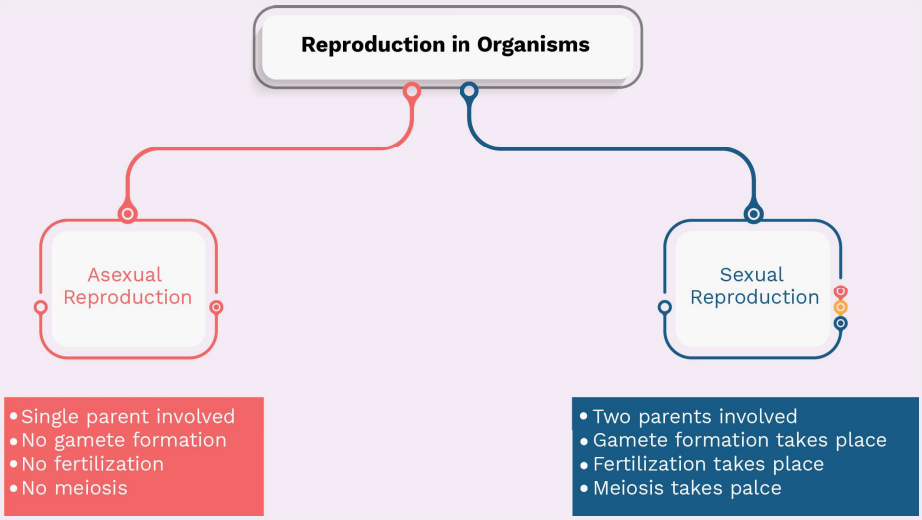
Gray Matter Alert!!!

Largest seed: *Lodoicea maldivica* (double coconut)
Smallest seed: Orchid

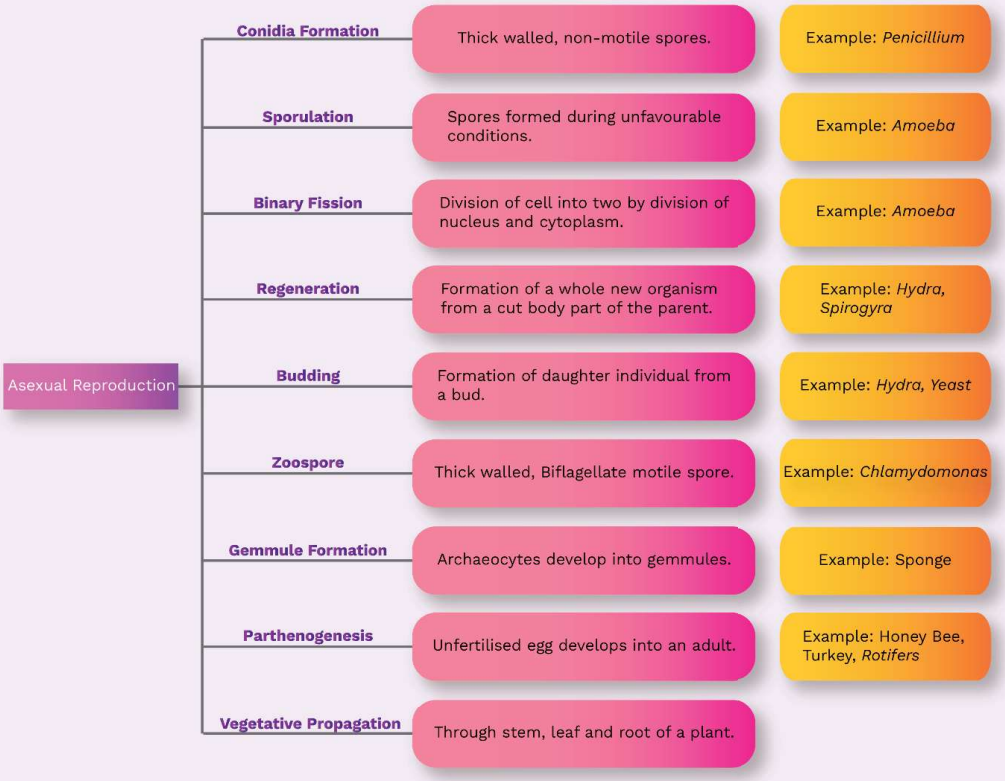
Aging or Senescence

- At the end of reproductive phase, senescence or aging sets in.
- It is the last phase of lifespan.

Summary

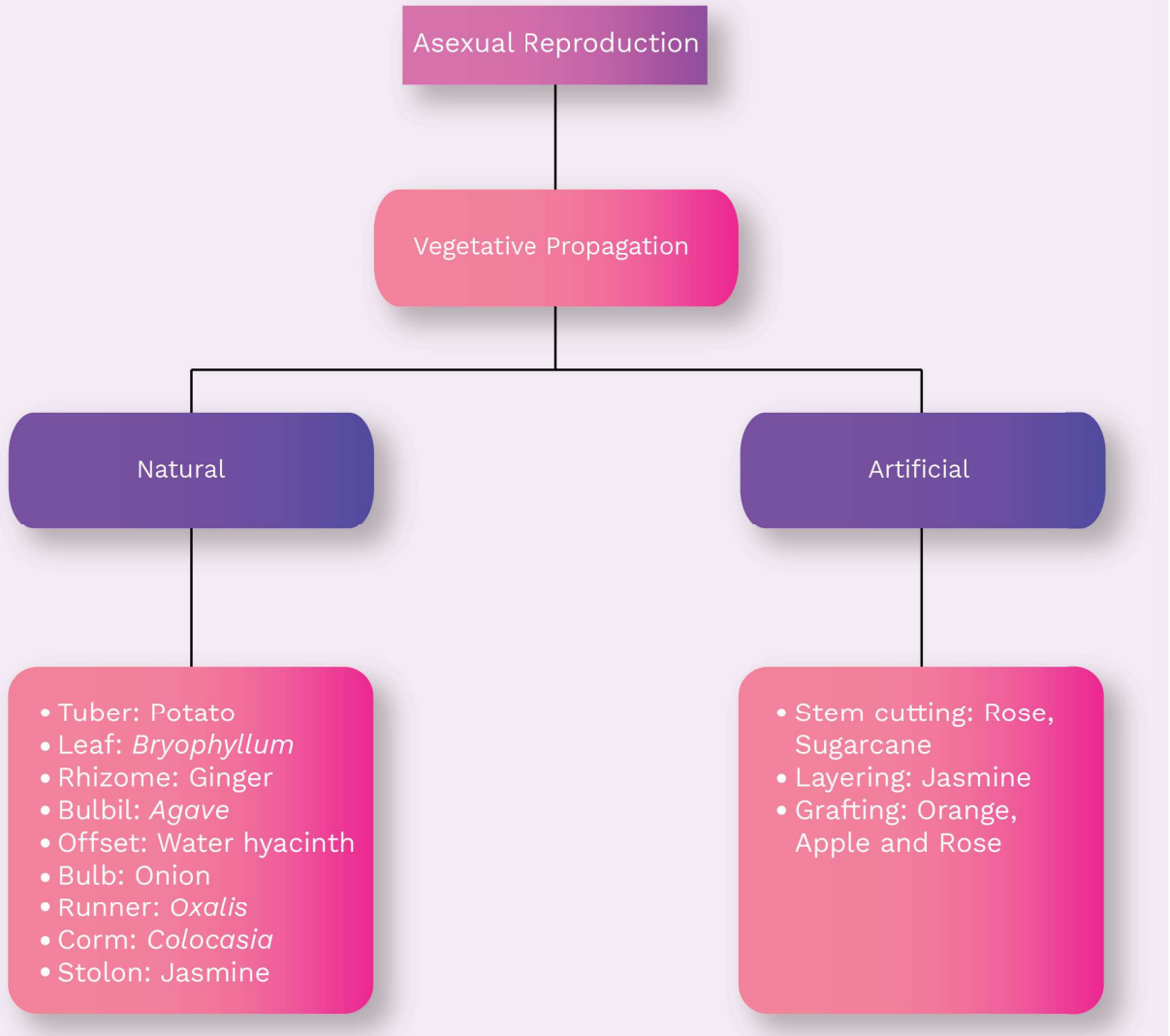


Types of Reproduction in Organisms



Types of Asexual Reproduction

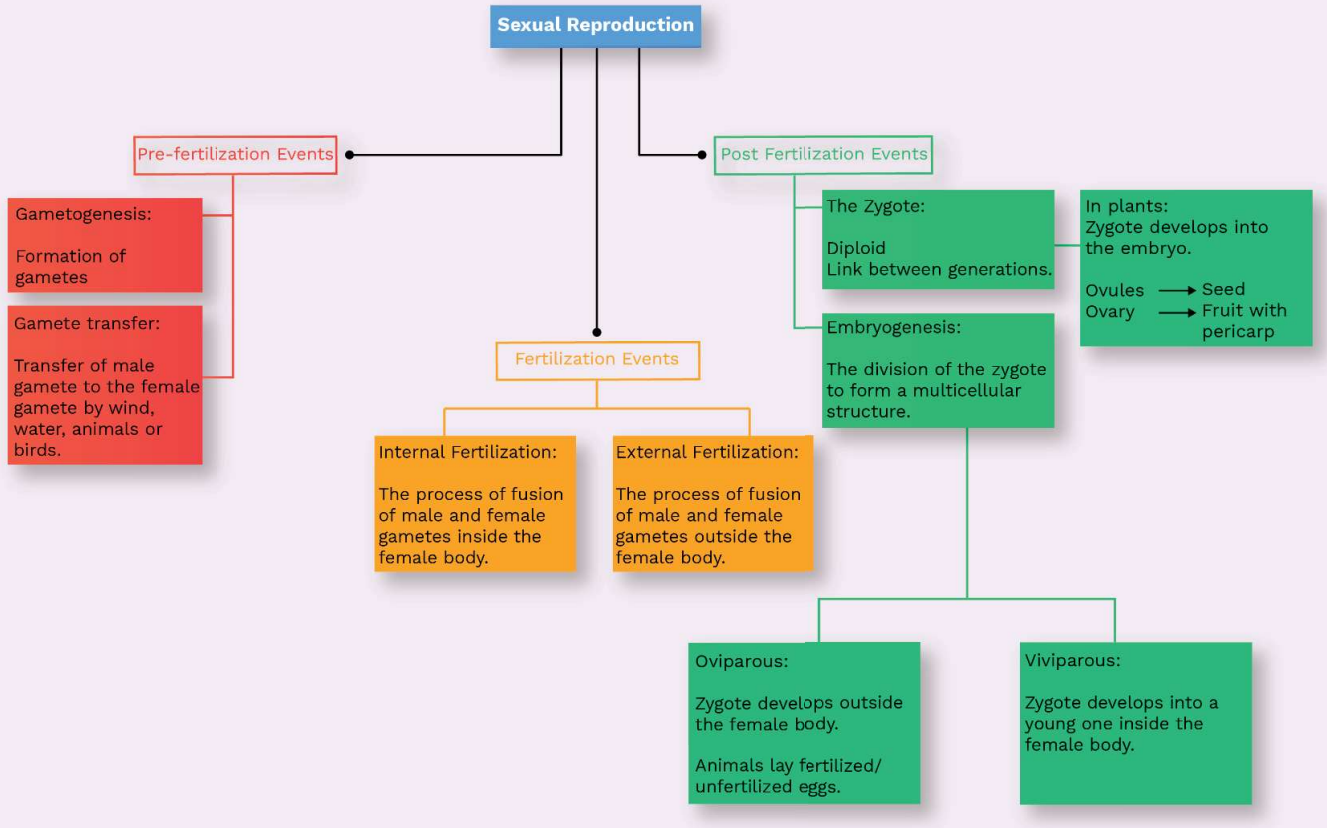
Summary



Types of Vegetative Propagation

Summary

Events in Sexual Reproduction



SOLVED EXERCISE

Q1 **Which one of the following statements is not correct?**
(1) Offspring produced by the asexual reproduction is called clone.
(2) Microscopic, motile, asexual reproductive structures are called zoospores.
(3) In potato, banana and ginger, the plantlets arise from the internodes present in the modified stem.
(4) Water hyacinth, growing in the standing water, drains oxygen from water that leads to the death of fishes.

A1 **(3)**
Rest all are correct statements; in potato, banana and ginger new plantlet arises from the buds in the nodes.

Q2 **Which one of the following generates new genetic combinations leading to variation?**
(1) Vegetative reproduction (2) Parthenogenesis (3) Sexual reproduction
(4) Nucellar polyembryony

A2 **(3)**
In others, only one parent is involved. Thus, no genetic variation is possible.

Q3 **Which of the following organisms is considered to be immortal?**
(1) *Yeast* (2) *Chlamydomonas* (3) *Penicillium* (4) *Amoeba*

A3 **(4)**
Growth is always followed by binary fission.

Q4 **Which of the following pairs is not correctly matched?**
Mode of reproduction Example
(1) Binary fission *Sargassum* (2) Conidia *Penicillium*
(3) Offset Water hyacinth (4) Rhizome Banana

A4 **(1)**
Binary fission is shown by *Amoeba.*

Q5 **In ginger, vegetative propagation occurs through**
(1) bulbils (2) runners (3) rhizome (4) offsets

A5 **(3)**
Rhizome is a modified underground stem, helping in vegetative propagation.

Q6 **In oogamy, fertilization involves**
(1) a small, non-motile female gamete and a large motile male gamete
(2) a large, non-motile female gamete and a small motile male gamete
(3) a large, non-motile female gamete and a small non-motile male gamete
(4) large, motile female gamete and a small non-motile male gamete.

A6 **(2)**
In oogamy, the female gamete is large and non-motile while, male gamete is small and motile.

Q7 **Regeneration by the transformation of already present body tissues is known as**
(1) morphogenesis (2) epimorphosis
(3) morphallaxis (4) accretionary growth

A7 **(3)**
Morphallaxis is the process of regeneration by transformation of body tissues that are already present.

Q8 **Parthenogenesis is seen in**
(1) Honey bee (2) Butterfly (3) Mayfly (4) Cockroach

A8 **(1)**
Others undergo normal sexual reproduction.

Q9 **'Nothing lives forever, but life continues'. What does it mean?**
(1) Older die but new are produced due to reproduction.
(2) Nothing can produce without death.
(3) Death has nothing to do with the continuation of life.
(4) Parthenogenesis is must for sexual reproduction.

A9 **(1)**
Life on earth continues due to reproduction.

Q10 **Which of the following organisms undergo both regeneration and budding?**
(1) *Hydra* **(2)** *Yeast* **(3)** *Penicillium* **(4)** *Chlamydomonas*

A10 **(1)**
Others have only one mode of asexual reproduction.