

BIOLOGY

Chapter 1: Reproduction In Organisms



Reproduction In Organisms

Life Span: The period which begins from birth and ends with the natural death of an organism is known as its life span.



Reproduction

Reproduction is a biological process wherein younger ones produced are identical to their parents. This phenomenon is significant in the continuity of the species, generation after generations. Typically, reproduction is observed in all living organisms from single-celled entities such as amoeba to multicellular entities of the most advanced forms, such as human beings. Reproduction is carried out in two modes, depending upon the participation of one or both parents.

Types of Reproduction:

Based on whether there is one or two organisms taking part in the process of reproduction.

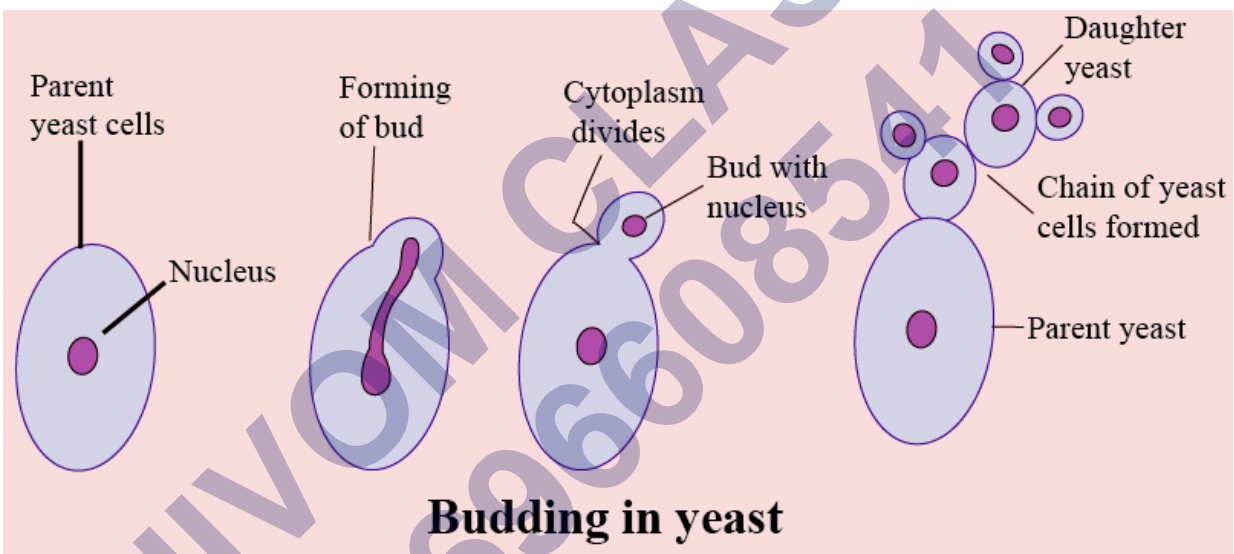
- Asexual Reproduction
- Sexual Reproduction

Asexual Reproduction: When the offspring is produced by single parents with or without the involvement of gamete formation, the reproduction is called asexual reproduction.

Sexual Reproduction: When two parents (opposite sex) participates in reproduction process and also involves the fusion of male and female gametes, it is called sexual reproduction.

Mode of Asexual Reproduction:

- Usually followed by organisms with relatively simpler organizations.
- Offsprings produced by single parent.
- With/ without involvement of gamete formation.
- **Clones:** Offsprings produced are genetically and morphologically similar to each other and to the parent, i.e. they are clones.
- In Protista and Monera, the parent cells divide into two to give rise to new individuals. Thus, in these organisms cell division is the mode of reproduction itself.
- Binary fission in this method of asexual reproduction, a cell divides into two halves and rapidly grows into an adult. Ex. amoeba, paramecium.
- Budding small buds are produced that remain attached initially with parents and get separated on maturation. Ex. Yeast.



- Fungi and simple plants like algae reproduce through special reproductive structures like zoospores (motile structure), conidia (penicillium), buds (hydra) and gemmules (sponges).
- In plants, vegetative reproduction occurs by vegetative propagules like runner, rhizome, sucker, tuber, offset and bulb.
- Asexual reproduction is the most common method of reproduction in organisms having simpler body like in algae and fungi but during unfavourable condition they shift to sexual reproduction.

Vegetative Propagation:

It is a type of process in which new plants are obtained without the production of sexual structures i.e., seeds or spores. It involves the propagation of plants through different types of vegetative parts such as the rhizome, sucker, tuber, bulb, etc. In this, a fusion of the male and the female gamete does not take place and requires

only one parent. This is grouped into natural and artificial.

Vegetative Propagules:

- Runner- oxalis
- Sucker- Mint and Chrysanthemum
- Tuber- potato
- Offset- water hyacinth, pistia
- Bulb- onion, garlic
- Rhizome- ginger
- Bulbil- agave
- Leaf buds- Bryophyllum

Artificial Methods: In this type of method, only a small part of the plant organ is utilized for obtaining a new complete plant. Amongst them, the most common methods which are used are cutting, layering, and grafting.

Cutting: In cutting, a small piece of root is cut and when planted in moist soil, it will lead to the artificial inducement and development of adventitious roots. For example, in lemon.

In Rose, sugarcane, hibiscus, and chrysanthemum plants are developed by cuttings that involve stem pieces with the presence of nodes. The small cuttings are planted in moist soil to develop new plants. Underground parts of the stem leading to the development of adventitious roots, whereas buds develop and sprout on the aerial parts of stems. The new plants are in a common language known as cutting. Later, these cuttings are transplanted in different prepared places.

Layering: This method is used for growing rose, lemon, grape, hibiscus, and jasmine. The lower branches of these plants are bent a little bit and covered with soil in such a way that the tip of the branch protrudes from the ground and the middle part of the plant is inside the soil. It will then develop adventurous roots from this buried area of the stem of the plant, at that time this branch is cut off and separated from the mother plant, whereby a new plant is obtained.

Grafting: Grafting is carried out on plants that are having difficulty in forming roots or that generally have a weak root system. This method involves joining two plants of the same or different species, this is achieved by connecting the tissues of the two plants directly to The. When brought into contact, the meristematic tissue of both plants divides and multiplies, and finally the cells of each plant fuse.

The rooted plant is called the stem plant. The plant that is grafted onto it is called the sprout. A plant is selected as the "scion" that has superior and desirable properties. The stock is generally strong, robust, and resilient, mango, apple, pear, citrus, guava, lychee, and many other fruit plants are obtained and kept in this

way. The graft can be of several types, namely, bud graft, lateral graft, and tongue graft, wedge graft, and crown graft, depending on the methods of joining the two parts.

Significance of Vegetative Reproduction:

- Vegetative reproduction is an ideal method of reproduction in plants in which we want to preserve parental characteristics.
- It is best for plants that are less efficient sexually, small seeds, long seed dormancy, poor seed viability, etc. They can also be easily multiplied by this method.
- Vegetative propagation is useful for obtaining disease-free plants.
- By using grafting, the desired characters can be brought together from two varieties.

Water Hyacinth (Terror of Bengal)

- One of the most invasive weeds.
- Grows wherever there is standing water.
- Drains oxygen from water- leads to death of fishes.
- Introduced in India because of its pretty flowers & shape of leaves.
- Vegetative propagation occurs at a phenomenal rate.

Sexual Reproduction:

- Involves formation of male and female gamete by two individuals of the opposite sex.
- Offspring produced by fusion of male and female gametes not identical to each other or to the parents.
- All sexually reproducing organisms share a similar pattern of reproduction.
- In sexual reproduction, fusion of male and female gametes results in offspring that are not identical to parents.

Different Phases in Sexual Reproduction:

Juvenile phase: It is the period of growth after birth in an individual organism, and before it meets reproductive maturity.

Reproductive phase: It is the time when a human organism sexually reproduces.

Senescent phase: It is the end of reproductive phase. Old age ultimately leads to death

Events in Sexual Reproduction: Pre-fertilization, Fertilization, Post-fertilization

Pre-fertilization: all the events prior to fusion of gametes are included in it. It includes gametogenesis and gamete transfer.

Gametogenesis: Is the process of formation of male and female gametes. Gametes are haploid cells which may be similar or dissimilar in structure. In algae, When both gametes are similar in structure called homogametes (isogametes). In higher organism that reproduces sexually, two morphologically distinct gametes are formed called heterogametes, male gametes are called antherozoid or sperm and female gametes are called ovum or egg.

Isogametes Heterogametes:

In fungi and plants, homothallic and monoecious terms are used to denote the bisexual condition and heterothallic and dioecious are used for unisexual condition. In flowering plants, the unisexual male flower is staminate, i.e., bearing stamens, while the female is pistillate or bearing pistils.

In animals, species which possess both male and female reproductive organs in same individual are called bisexual or hermaphrodites (earthworm, sponges, tapeworm etc.) and both having either male or female reproductive organs are called unisexual (cockroach, human).

Gametes are always haploid(having half set of chromosome), although organisms may be haploid and diploid. Diploid organisms form gametes by meiotic division. The organisms belonging to algae, fungi, and bryophytes have haploid plant body and pteridophytes, gymnosperms, angiosperms and most of animals are diploid (having double set of chromosome)

In diploid organisms, gamete mother cell (meiocyte) undergoes meiosis in which one set of chromosome is present in gametes.

Gamete Transfer:

In majority of organisms, male gametes are motile and females gametes are non-motile, except in fungi and algae in which both gametes are motile. In simple plants like algae, fungi, bryophytes and pteridophytes water is the medium through which male and female gametes moves. The number of male gametes are much more than number of female gametes as most of male gametes fail to reach the female gametes.

In higher plants pollen grains are carrier of male gametes and ovule has eggs.

Pollen grains must be transferred from anther to stigma to facilitate fertilization.

Pollination: The transfer of pollen grains from anther to stigma is called pollination. Pollination may be self (anther to stigma of same flower) or cross (anther to stigma of different flower).

Pollen grains germinate on stigma to produce pollen tube that delivers the male gametes near the ovule.

Fertilization: The fusion of male and female gamete is called fertilization or syngamy. It results in the formation of diploid zygote.

Parthenogenesis: The process of development of new organisms without fertilization of female gametes is called parthenogenesis. For example honey bee, rotifers, and lizards.

There are two types of fertilization:

- i. **External Fertilization:** Syngamy occurs outside the body of the organism. Large numbers of gametes are released in the surrounding medium. Example: Bony fishes and Amphibians.
- ii. **Internal Fertilization:** Syngamy occurs inside the body of the organism. Numbers of ova produced are less, but large numbers of male gametes are released and they travel towards the ovum. Example: Birds and Mammals.

Post Fertilization Events: events in the sexual reproduction after formation of zygote.

Zygote is the link that ensures continuity of species between organisms of one generation and the next. Every sexually reproducing organism, including human beings, begin life as a single cell—the zygote.

In the organisms, having external fertilization, zygote is formed in external medium (water) and those having internal fertilization zygote is formed inside the body of female.

In algae and fungi, zygote develops a thick wall resistant to desiccation and damage. This germinates after a period of rest.

In the organisms having haplontic life cycle, zygote divides to form haploid spores that germinate to form haploid individual.

Embryogenesis: the process of development of embryo from the zygote. During this, zygote undergoes mitotic division and cell differentiation. Cell division increase the number and cell differentiation help information of new group of cells and organs.

There are two types of animals:

Oviparous: Development of zygote takes place outside the body of organisms and lay fertilized of unfertilized eggs. Example: Reptiles and birds.

Viviparous: Development of zygote takes place inside the body of organisms and produces young ones. Example: Human, dog, horse etc.

Pericarp: In flowering plants, zygote is formed inside the ovule. After fertilization, sepals, petals and stamens of flower fall off. The zygote develops into embryo and ovules into seeds. The ovary develops into fruits which develop a thick wall called pericarp, protective in function.

In animals:

By Copulation: e.g., Reptiles, Birds and Mammals.

By External medium: e.g., Fishes and Amphibians.

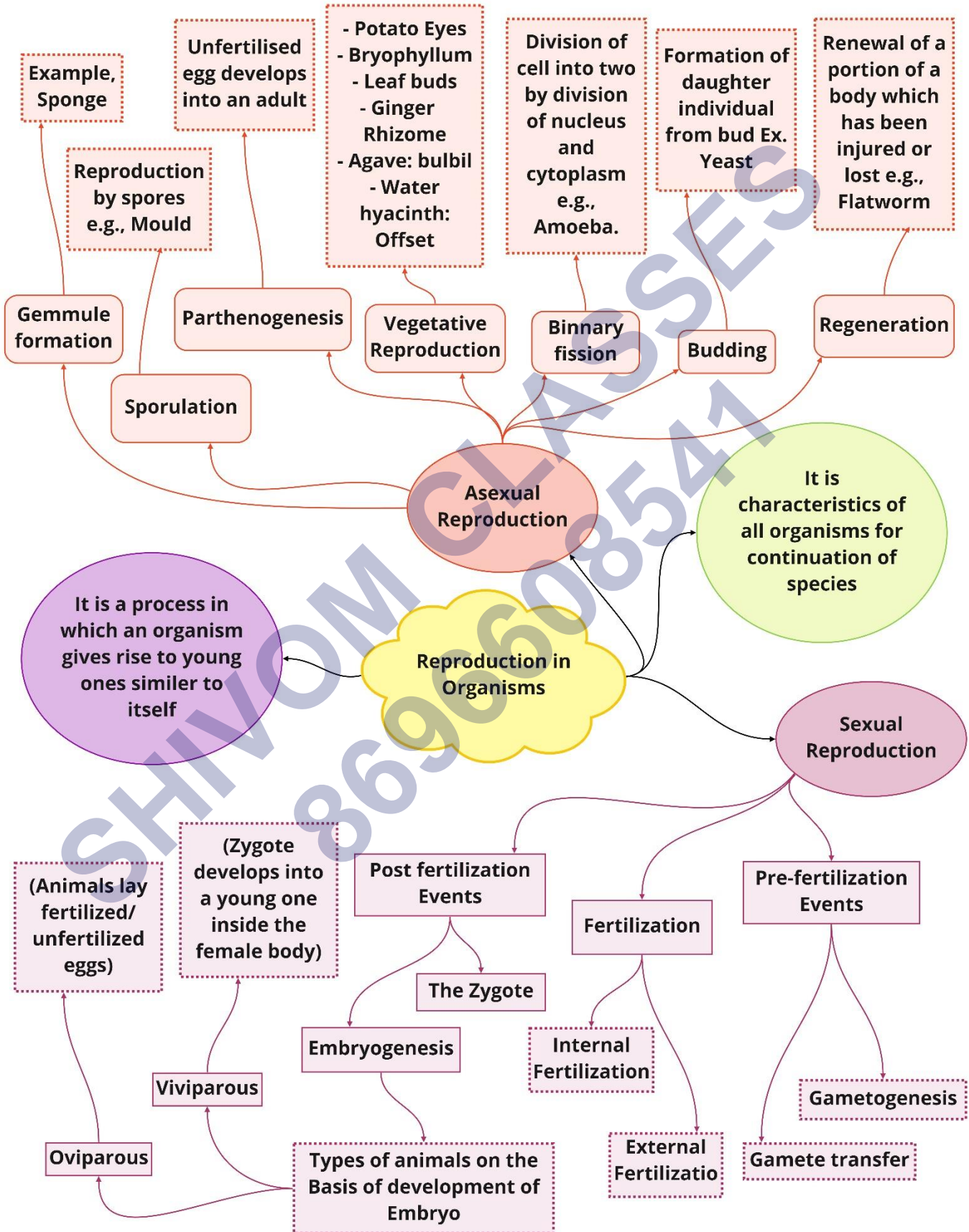
Sporulation: During unfavourable conditions organisms like Amoeba surrounded by resistant coat (three layered—hard covering) or cyst. This is called encystation. Within cyst a number of spores are formed. On returning favourable conditions, the cyst burst and spores are liberated and gradually grows in adults. This process is known as sporulation (multiple fission).

Fragmentation: It is a type of asexual reproduction where an organism splits into fragments. Their fragments develops into fully grown individual. e.g. spirogyra, fungi and some annelids.

Regeneration: It is a process of renewal, restoration and growth. It can occur at the level of the cell, tissue and organ. It is common in Hydra, Planaria and echinoderms

- In human, liver has power of regeneration, if it is partially damaged.
- During danger a lizard discard a part of its tail which can regenerate later.

Class : 12th Biology
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Important Questions

➤ Multiple Choice Questions:

1. A few statements describing certain features of reproduction are given below:

- (i) Gametic fusion takes place
- (ii) Transfer of genetic material takes place
- (iii) Reduction division takes place
- (iv) Progeny have some resemblance with parents

Select the options that are true for both asexual and sexual reproduction from the options given below:

- (a) i and iii
- (b) ii and iii
- (c) ii and iv
- (d) i and iii

2. The term 'clone' cannot be applied to offspring formed by sexual reproduction because:

- (a) Offspring do not possess exact copies of parental DNA.
- (b) DNA of only one parent is copied and passed on to the offspring.
- (c) Offspring are formed at different times
- (d) DNA of parent and DNA of offspring are completely different.

3. Amoeba and Yeast reproduce asexually by fission and budding respectively, because they are:

- (a) Microscopic organisms
- (b) Heterotrophic organisms
- (c) Unicellular organisms
- (d) Uninucleate organisms.

4. A few statements with regard to sexual reproduction are given below:

- (i) Sexual reproduction does not always require two individuals.
- (ii) Sexual reproduction generally involves gametic fusion.
- (iii) Meiosis never occurs during sexual reproduction
- (iv) External fertilisation is a rule during sexual reproduction.

Choose the correct statements from the options below:

- (a) i and iv
- (b) i and ii
- (c) ii and iii

- (d) i and iv
5. A multicellular, filamentous alga exhibits a type of sexual life cycle in which the meiotic division occurs after the formation of zygote. The adult filament of this alga has
- (a) Haploid vegetative cells and diploid gametangia
 - (b) Diploid vegetative cells and diploid gametangia
 - (c) Diploid vegetative cells and haploid gametangia
 - (d) Haploid vegetative cells and haploid gametangia.
6. The male gametes of rice plant have 12 chromosomes in their nucleus. The chromosome number in the female gamete, zygote and the cells of the seedling will be respectively
- (a) 12, 24, 12
 - (b) 24, 12, 12
 - (c) 12, 24, 24
 - (d) 24, 12, 24
7. Given below are a few statements related to external fertilisation. Choose the correct statements.
- (i) The male and female gametes are formed and released simultaneously.
 - (ii) Only a few gametes are released into the medium.
 - (iii) Water is the medium in a majority of organisms exhibiting external fertilisation.
 - (iv) Offspring formed as a result of external fertilisation have better chance of survival than those formed inside an organism.
- (a) iii and iv
 - (b) i and iii
 - (c) ii and iv
 - (d) i and iv
8. The statements given below describe certain features that are observed in the pistil of flowers.
- (i) Pistil may have many carpels
 - (ii) Each carpel may have more than one ovule
 - (iii) Each carpel has only one ovule
 - (iv) Pistil has only one carpel

Choose the statements that are true from the options below:

- (a) i and ii
- (b) i and iii
- (c) ii and iv
- (d) iii and iv

9. Which of the following situations correctly describe the similarity between an angiosperm egg and a human egg?
- (i) Eggs of both are formed only once in a lifetime
 - (ii) Both the angiosperm egg and human egg are stationary
 - (iii) Both the angiosperm egg and human egg are motile.
 - (iv) Syngamy in both results in the formation of zygote
- Choose the correct answer from the options given below:
- (a) ii and iv
 - (b) iv only
 - (c) iii and iv
 - (d) i and iv
10. Appearance of vegetative propagules from the nodes of plants such as sugarcane and ginger is mainly because:
- (a) Nodes are shorter than internodes
 - (b) Nodes have meristematic cells
 - (c) Nodes are located near the soil
 - (d) Nodes have non-photosynthetic cells
11. Which of the following statements supports the view that elaborate sexual reproductive process appeared much later in the organic evolution?
- (i) Lower groups of organisms have simpler body design
 - (ii) Asexual reproduction is common in lower groups
 - (iii) Asexual reproduction is common in higher groups of organisms
 - (iv) There is high incidence of sexual reproduction in angiosperms and vertebrates.
- Choose the correct answer from the options given below:
- (a) i and ii
 - (b) i and iii
 - (c) ii and iv
 - (d) ii and iii
12. Offspring formed by sexual reproduction exhibit more variations than those formed by asexual reproduction because:
- (a) Sexual reproduction is a lengthy process
 - (b) Gametes of parents have qualitatively different genetic composition
 - (c) Genetic material comes from parents of two different species
 - (d) Greater amount of DNA is involved in sexual reproduction.
13. Choose the correct statement from amongst the following:

- (a) Dioecious (hermaphrodite) organisms are seen only in animals
- (b) Dioecious organisms are seen only in plants
- (c) Dioecious organisms are seen in both plants and animals
- (d) Dioecious organisms are seen only in vertebrates.

14. There is no natural death in single celled organisms like Amoeba and bacteria because:

- (a) They cannot reproduce sexually
- (b) They reproduce by binary fission
- (c) Parental body is distributed among the offspring
- (d) They are microscopic.

15. There are various types of reproduction. The type of reproduction adopted by an organism depends on:

- (a) The habitat and morphology of the organism
- (b) Morphology of the organism
- (c) Morphology and physiology of the organisms
- (d) The organism's habitat, physiology and genetic makeup

➤ Very Short Question:

1. Offsprings produced by asexual reproduction are referred to as clones. Why?
2. Name the most invasive aquatic plant weed which is called as Terror of Bengal.
3. How does Zygote usually differ from Zoospore in terms of ploidy?
4. Mention the main difference between the offspring produced by asexual reproduction and progeny produced by sexual reproduction.
5. Which characteristic property of Bryophyllum is exploited by gardeners and farmers?
6. What represents the life span of an organism?
7. Which individuals can be termed as clones?
8. How do the following organisms reproduce: Paramecium and Penicillium?
9. State the function of a vegetative propagule.
10. How will you grow a banana and a ginger plant?

➤ Short Questions:

1. Higher organisms have resorted to sexual reproduction in spite of its complexity. Why?
2. Tapeworms possess both male and female reproductive organs. What is the name given to such an organism? Give two more examples of such organisms.
3. Study the relationship between the first two words and suggest a suitable word for the fourth place.

- (a) Male flower: Stamens :: Female Flower :
- (b) Birds: oviparous :: Primates :
- (c) Chlamydomonas : Zoospores :: Penicilium :
- (d) Ginger: Rhizome :: Agave :

4. Bryophytes and Pteridophytes produce a large number of male gametes but relatively very few female gametes. Why?
5. Enlist the significance of reproduction.
6. Why do hilly areas of Kerela, Karnataka and Tamil Nadu transform into blue stretches that attracts many tourists?
7. Define 'oestrus' and 'menstrual' cycles.
8. What regulates the reproduction processes and the associated behavioural expressions in organisms?

➤ Long Questions:

1. Explain the process of budding in yeast.
2. Describe the importance of vegetative propagation.
3. Describe the post-fertilisation changes in a flower.

➤ Assertion & Reason Questions:

1. For two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
 - a. Both assertion and reason are true, and reason is the correct explanation of assertion.
 - b. Both assertion and reason are true, but reason is not the correct explanation of assertion.
 - c. Assertion is true, but reason is false.
 - d. Both assertion and reason are false.

Assertion: Asexual reproduction involves formation of clones of an organism.

Reason: Clones are morphologically and genetically similar individuals.

2. For two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
 - a. Both assertion and reason are true, and reason is the correct explanation of assertion.
 - b. Both assertion and reason are true, but reason is not the correct explanation of assertion.
 - c. Assertion is true, but reason is false.
 - d. Both assertion and reason are false.

Assertion: Several seed bearing plants propagate vegetatively.

Reason: Sweet potatoes undergo vegetative propagation by means of root tubers.

✓ Answer Key-

➤ Multiple Choice Answers:

1. (c) ii and iv
2. (a) Offspring do not possess exact copies of parental DNA.
3. (c) Unicellular organisms
4. (b) i and ii
5. (d) Haploid vegetative cells and haploid gametangia.
6. (c) 12, 24, 24
7. (b) i and iii
8. (a) i and ii
9. (b) iv only
10. (b) Nodes have meristematic cells
11. (c) ii and iv
12. (b) Gametes of parents have qualitatively different genetic composition
13. (c) Dioecious organisms are seen in both plants and animals
14. (c) Parental body is distributed among the offspring
15. (d) The organism's habitat, physiology and genetic makeup

➤ Very Short Answers:

1. Because offsprings produced by Asexual reproduction is morphologically and genetically identical to parent.
2. Water hyacinth (Eicchornia)
3. Zygote diploid, zoospore haploid.
4. Offspring produced by asexual reproduction are genetically similar while progeny produced by sexual reproduction exhibit genetic variation.
5. Adventitious bud arising from margin of the leaf.
6. The period from the birth to the natural death of an organism represents its life span.
7. The individuals who are morphologically and genetically identical are called clones.
8. a) Paramecium reproduces by the process of binary fission.
b) Penicillium reproduces with the help of asexual structures called conidia.

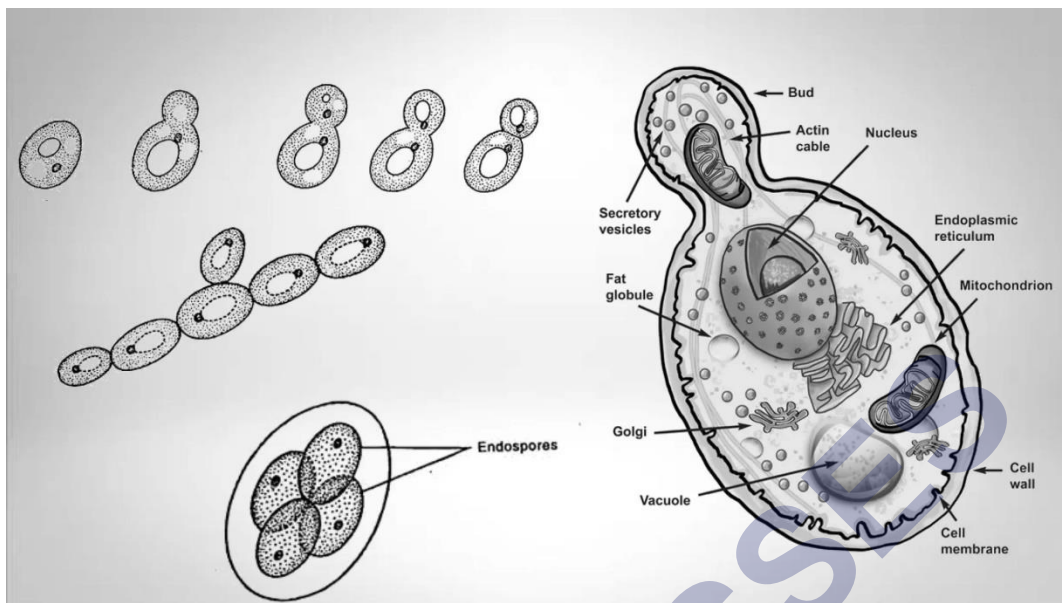
9. The vegetative propagules are the asexual vegetative structures of the plant that are capable of giving rise to a new plant.
10. The rhizomes of a banana and a ginger are used to propagate new plantlets.

➤ Short Answer:

1. Because of variations, gene pool, Vigour and Vitality and Parental care.
2. Hermaphrodite; Examples : Earthworm, Leech.
3. (a) Carpel (b) Viviparous
(c) Conidia (d) Bulbil
4. Because male gamete need medium (water) to reach egg/female gamete. A large number of the male gametes fail to reach the female gamete.
5. Significance of reproduction includes:
 - Propagation of species.
 - Sustenance of life on this planet.
 - Variation introduced during reproduction plays a role in evolution of new species.
6. Strobilanthus kunthiana which flowers only once in every 12 years flowered in 2006 that resulted into transformation of the hilly tracks of Kerela, Karnataka and Tamil Nadu into blue stretches.
7. Non- Primates like cows, sheep etc. show certain cyclic changes during reproduction called oestrus cycle while Primates like apes, humans the cycle is referred to as menstrual cycle.
8. Interaction between hormones and certain environmental factors regulate the reproductive processes and the associated behavioural expressions of organisms.

➤ Long Answer:

1. Budding in yeast. It is a common type of vegetative reproduction. In a medium which is abundantly supplied with sugar, yeast cytoplasm forms a bud-like outgrowth. The growth soon enlarges and a part of the nucleus protrudes into the bud and breaks off. The bud then begins to grow and then separates from the mother cell. Often it will itself form a bud before it breaks away, and straight or branched chains are produced.

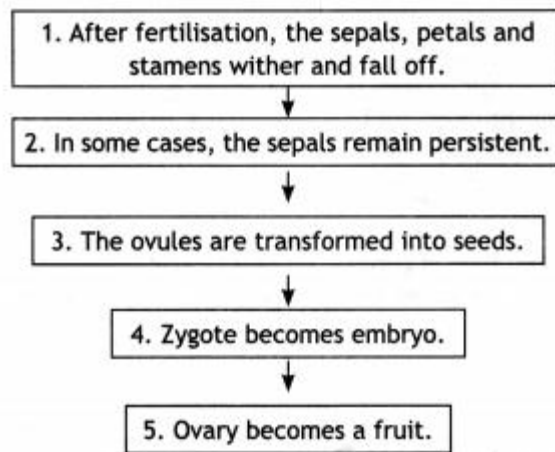


Thus, as a result, branched or unbranched chains of cells called pseudo mycelium are produced. The cells are loosely held together. Sooner or later they become independent.

2. Merits of vegetative propagation:

- i. Plants produced by vegetative propagation are genetically similar and constitute a uniform population called a clone.
- ii. Plants with reduced power of sexual reproduction, long dormant period of seed, poor viability, etc. are multiplied by vegetative methods.
- iii. Some fruit trees like banana and pineapple do not produce viable seeds. So these are propagated by only vegetative methods.
- iv. It is a more rapid and easier method of propagation.
- v. Good characters are preserved by vegetative propagation.
- vi. Some plants such as doob grass (*Cynodon dactylon*) which produce only a small quantity of seed are mostly propagated by vegetative propagation.
- vii. Grafting helps in getting an economically important plant having useful characteristics of two different individuals in a short time.

3. Post-fertilisation changes in a flower.



➤ Assertion and Reason Answers:

1) b) Both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation:

The reproduction is known as asexual reproduction, when an offspring is produced by a single parent without the involvement of gamete formation. As a result, the offspring that are produced are not only similar to one another but are also exact copies of their parent. Such a group of morphologically and genetically similar individuals are called clones.

2) b) Both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation:

Formation of new plants by means of vegetative units as tubers, buds, rhizomes is called vegetative propagation. It is useful for producing large number of offsprings within a short time and for preserving qualities such as disease resistance. In sweet potato, root tubers take part in vegetative propagation.