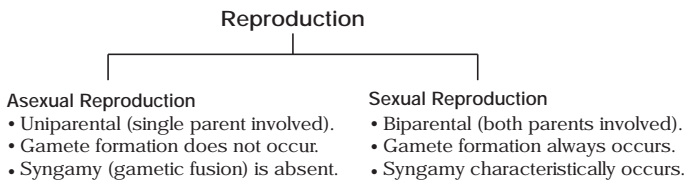


Reproduction in Organisms

Reproduction is the process of producing offspring similar to itself. It is a characteristic feature of living organisms.

Biologically it means the multiplication and perpetuation of the species.

According to the conditions available in environment, organisms have adapted the processes of reproduction. Generally, two types of reproduction mechanisms are present in organisms.



Reproduction in Plants

Plants also reproduce by both asexual and sexual methods.

Asexual Reproduction in Plants

The asexual reproduction in plants is also known as vegetative propagation.

In both lower and higher plants, it occurs by following methods

- (i) **Vegetative propagules** There are various vegetative propagules involved in asexual reproduction. These are discussed in chapter 19. These may be tuber, runner, sucker, corm, stolons, offset, bulbil and rhizome, etc.
- (ii) **Fragmentation** This method is common in algae, fungi and lichens. The small fragments of plant body led to the formation of new individuals.
- (iii) **Fission** This process of reproduction is found in yeast, algae and bacteria. The organism divides into two or more halves.
- (iv) **Budding** Mostly occurs in yeasts. Small protruding vegetative outgrowths, develop into new organism after detaching from the mother plant.
- (v) **Spores** Algae, fungi, bryophytes and pteridophytes reproduce by this method. Spores are usually microscopic structures.
- (vi) **Conidia** Series of rounded structures in several fungi and algae called conidia. After detaching, these germinate into new plants.

Sexual Reproduction in Plants

The plants also reproduce sexually in which fertilisation of male and female gametes takes place and zygote is formed. Gametic cells (i.e., sperm and egg) are produced by the meiotic division.

In lower plants, these gametes fuse directly through their cells and show isogamy (fusion between similar gametes), anisogamy (fusion between dissimilar gametes) and oogamy (fusion between well-defined gametes).

In bryophytes and pteridophytes, these gametes are formed in well-defined structures like antheridia (for male gametes) and archegonia (for female gametes), while in phanerogams, these are situated inside more pronounced structures like androecium (for male gametes) and gynoecium (for female gametes).

Reproduction in Animals

Animals reproduce by both asexual and sexual methods.

Asexual Reproduction in Animals

It is the primary means of reproduction among the protists, cnidarians and tunicates.

The process of asexual reproduction can occur through following methods

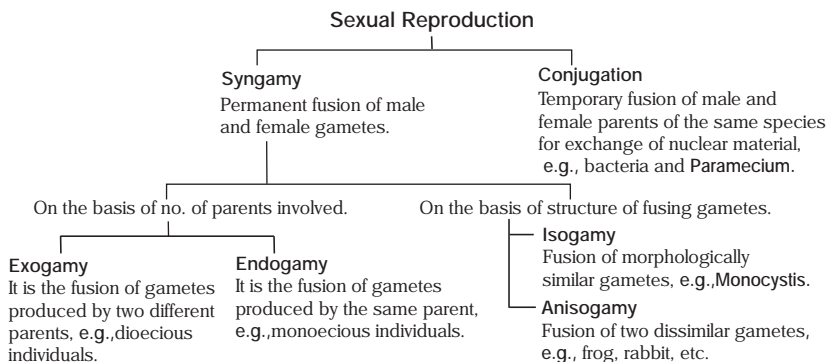
- (i) **Regeneration** It is the formation of whole body of an organism from the small fragment of parent body, e.g., Planaria, Hydra, etc.
- (ii) **Fission** The parent body is divided into two or more daughter cells, which become new individual, e.g., planarians, protozoans, etc.
- (iii) **Budding** Small projections or outgrowths in protozoans and sponges. Projection is called bud, later bud develops into new organisms, e.g., yeast and coelenterates.
- (vi) **Fragmentation** The parent body breaks into two or more fragments. Each fragment becomes, new organism, e.g., sponges and echinoderms.
- (v) **Strobilisation** In this, the ring-like constrictions are developed and organisms look like a pile of minute saucers, e.g., Aurelia.
- (vi) **Spore formation** The propagules which germinate to form new individual, e.g., Funaria, Claviceps, Toxoplasma gondii, etc.
- (vii) **Gemmules** These are the asexual? reproductive structures present in several sponges. These are internal buds, e.g. Spongilla lacustris.

Sexual Reproduction in Animals

In animals, the sexual reproduction occurs by the fertilisation of haploid sperm and haploid egg, to generate a diploid offspring.

In most individuals (i.e., dioecious), females produce eggs (i.e, large non-motile cells containing food reserve) and males produce sperms (i.e., small, motile cells and have almost no food reserve).

In other individuals (i.e., monoecious) such as earthworm and many snails, single individual produces both sperms and egg. These individuals are called as hermaphrodite. The union of sperm and egg occurs in variety of ways depending on the mobility and the breeding environment of individual, sexual reproduction is of two types



Other Modes of Sexual Reproduction

- (i) Autogamy Fusion of male and female gametes produced by same individual, e.g., *Paramecium*.
- (ii) Hologamy Fusion of entire mating individuals acting as gametes, e.g., *Chlamydomonas*.
- (iii) Paedogamy Fusion of young individuals, e.g., *Actinosphaerium*.
- (iv) Merogamy Fusion of small and morphologically dissimilar gametes.
- (v) Macrogamy Fusion of two macrogametes takes place.
- (vi) Microgamamy Fusion of two microgametes takes place.
- (vii) Cytogamy Fusion of cytoplasm of two individuals, but no nuclear fusion, e.g., *P. aurelia*.
- (viii) Plasmogamy Fusion of related cytoplasm, e.g., fungi.
- (ix) Karyogamy Fusion of nuclei of two gametes, e.g., *Mucor*.
- (x) Automixis Fusion of gamete nuclei of the same cell, e.g., phasmids.

Events of Sexual Reproduction in Both Plants and Animals

The events of sexual reproduction are though lengthy and complex, but follow a regular sequence. For easy understanding of the process, the process of sexual reproduction (i.e., fertilisation) can be divided into three distinct stages.

These are as follows

- (i) Pre-fertilisation events
- (ii) Fertilisation
- (iii) Post-fertilisation events.

1. Pre-Fertilisation Events

The events which occur before the fertilisation (i.e., gametic fusion) are included in this. These include gametogenesis and gamete transfer.

Gametogenesis

The process of gamete formation is known as gametogenesis. The gametes are generally of two kinds, male gametes and female gametes.

In some lower organisms, both male and female gametes are morphologically similar and are called isogametes or homogametes. In higher organisms, both male and female gametes are morphologically distinct and are called heterogametes.

Heterogametes $\left\{ \begin{array}{l} \text{Small—Microgamete/Male gamete—Spermatozoa} \\ \text{Large— Macrogamete/Female gamete—Ova} \end{array} \right.$

The gametes are usually formed by meiotic division, therefore they are haploid in nature.

Gamete Transfer

In most of the organisms, male gamete is motile and the female gamete is non-motile. The male gametes are produced in large number because large number of male gametes are failed to reach female gamete. In flowering plants through the process of pollination, male gametes reach to female gamete.

2. Fertilisation Events

In this stage, the most important event is the fusion of gametes (haploid) and formation of diploid zygote. This process is called syngamy or fertilisation.

The process of fertilisation may occur outside the body of organisms, called external fertilisation (e.g., algae, amphibians, fishes, etc).

If the syngamy occurs inside the body of organisms, it is called internal fertilisation (e.g., fungi, reptiles, birds, higher animals and plants).

In organisms like rotifers, honeybees, lizard and some birds, the female gametes form new organisms without fertilisation. This phenomenon is called parthenogenesis.

3. Post-Fertilisation Events

These are the events which take place after fertilisation and are majorly described under zygote and embryogenesis.

- ▮ **Zygote** The zygote is formed in all sexually reproducing organisms. Further, the development of zygote depends upon the type of life cycle and the environment of organism.
- ▮ **Embryogenesis** The process of development of an organism before birth is termed as embryogenesis. It involves gastrulation, formation of primary germinal layers to give rise to the entire body of organisms.
- ▮ **Oviparous Organisms** which lay eggs, to hatch out their young one are called oviparous animals, e.g., reptiles, birds, amphibians, etc.
- ▮ **Viviparous Organisms** which give birth to newborn young ones are termed as viviparous animals, e.g., primates, non-primates, etc.