

1. REPRODUCTION IN ORGANISMS

Reproduction -A biological process in which an organism gives rise to young ones (offspring) similar to itself. It enables a species to live generation after generation.

- Reproduction in organisms can be broadly classified into asexual and sexual reproduction.

1. Asexual Reproduction

- It is the production of offspring by a single parent without the involvement of gamete formation.
- The offspring formed by asexual reproduction are identical and are referred to as **clones**.
- Common in organisms that have a relatively simple organisation such as the fungi, algae and some invertebrate animals.

Types of Asexual reproduction

- In Monerans and Protists –Through cell division of the parent cell
 - Binary fission → Amoeba, Paramecium
 - Budding → Yeast
- In fungi and simple plants –Through special structures
 - Zoospores → *Chlamydomonas*
 - Conidia → *Penicillium*
- In simple animals - Through special structures
 - Buds → *Hydra*
 - Gemmules → *Sponge*
- In plants –Through vegetative propagules (parts which are not directly related with sexual reproduction)
 - Runner
 - Rhizome → ginger, banana
 - Sucker
 - Tuber → potato
 - Offset → water hyacinth
 - Bulbil → *Agave*
 - Leaf buds → *Bryophyllum*

Example for extensive vegetative reproduction
Known as the '**terror of Bengal**'

- The most invasive weeds found growing wherever there is standing water.
- It drains oxygen from the water, which leads to death of fishes.
- Since it can propagate vegetatively at a phenomenal rate and spread all over the water body in a short period of time, it is very difficult to get rid off them.

2. Sexual Reproduction

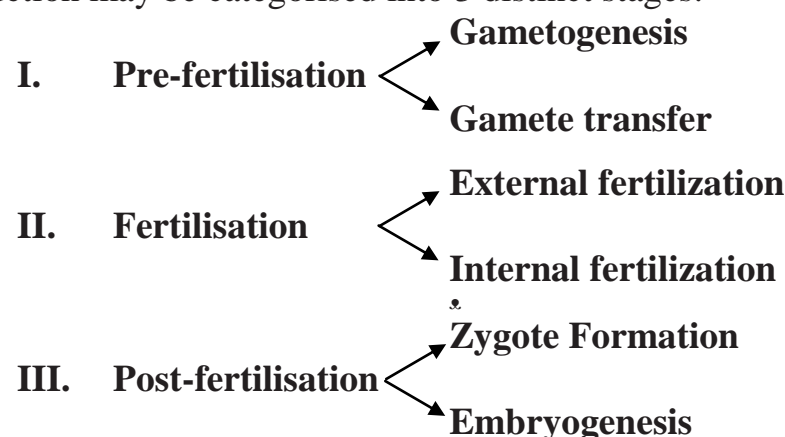
- Sexual reproduction** involves the formation male & female gametes (either by same individual or by different) and fusion of gametes to form the zygote which develops to form the new organism.
It is a complex and slower process as compared to asexual reproduction.
- As there is an occurrence of meiosis during the formation of gametes and fusion of different gametes, the resultant off spring are not identical to parents or to themselves.
- Most of the higher animals reproduce almost entirely by sexual method.

3 Phases of the life cycle of sexually reproducing organisms are:

- Juvenile phase**- The period of growth till attaining maturity for reproducing sexually (**Vegetative phase** in plants).
- Reproductive phase**-The period during which reproduction take place.
 - Seasonal breeders**-Organisms (living in natural condition) exhibiting reproductive cycles only during favourable seasons.
 - Continuous breeders**- Organisms those are reproductively active (naturally) throughout their reproductive phase.
- Oestrus cycle**- The cyclical changes in the activities of ovaries and accessory ducts as well as hormones during the reproductive phase in females of non-primate mammals
eg: cows, sheep, rats, deers, dogs, tiger, etc.
- Menstrual cycle**- The cyclical reproductive changes in females of primates
eg: monkeys, apes, and humans
- Senescent phase**-The period between the end of reproductive phase and death.
In both plants and animals, hormones are responsible for the transitions between the 3 phases.

Events in Sexual reproduction

- Events of sexual reproduction may be categorised into 3 distinct stages:-



I. Pre-fertilisation events

a) **Gametogenesis** -The process of formation of the two types of gametes – male and female. It is of 2 types.

Homogametes/Isogametes-Two gametes are similar. Both the gametes are motile and with same size.

Eg: *Cladophora*

Heterogametes-Disimilar gametes.

The male gamete is small, motile with one or two flagella, commonly called **antherozoid** or **sperm**

The female gamete is large, non-motile without flagella, commonly called **& egg** or **ovum**

Eg: *Fucus*

Sexuality in organisms:

Organisms may be bisexual or unisexual.

i. Unisexual/**heterothallic/dioecious**

→ Organisms with either male or female reproductive structures

e.g.: Papaya, date palm, *Marchantia*, Cockroach

ii. Bisexual/ **homothallic/ monoecious/ hermaphrodite**

→ Organisms with both male and female reproductive structures in the same individual

e.g.: Cucurbits, coconuts, *Chara*, earthworms, sponge, tapeworm, leech

Cell division during gamete formation :

Gametes are haploid in nature and usually a direct product of **meiotic** division except in haploid organisms where gametes are formed by **mitosis**.

b) **Gamete transfer**

Transfer of male gametes facilitate fusion (fertilization).

In unisexual animals it occurs by copulation or simultaneous release.

It is relatively easy in bisexual organisms.

In angiosperms, a special process called **pollination** ensures transfer of pollen grains which carry the pollen grains to the stigma.

II. Fertilisation

→ The process of fusion of male and female gametes is termed as **syngamy/ fertilization**.

• **Parthenogenesis**- Development of the female gamete to form new organisms without fertilisation.

• Syngamy may occur either externally, outside the body of organisms or internally, inside the body.

Features of external fertilization:-

- **Common in aquatic organisms** (algae and fishes as well as amphibians)
- **Show great synchrony** (release of male & female gamete at the same time) between the sexes.
- **Release a large number of gametes** into the surrounding medium (water) in order to enhance the chances of syngamy.
- Zygote is formed in the external medium (usually water)
- **Disadvantage**- The offspring are extremely vulnerable to predators

Features of internal fertilization:-

- Shown by terrestrial organisms, belonging to fungi, higher animals such as reptiles, birds, mammals and in a majority of plants (bryophytes, pteridophytes, gymnosperms and angiosperms)
- Egg is formed inside the female body
The male gamete is motile and has to reach the egg in order to fuse with it.
- Zygote is formed inside the body of the organism and there by protection to embryo.

III. Post-fertilisation events

a) **Formation of zygote**- Fertilisation leads to the formation of a specialised cell called zygote.

b) **Embryogenesis**- The process of development of embryo from the zygote.

• During embryogenesis, zygote undergoes **cell division** (mitosis) and **cell differentiation**.

• In animals, the zygote starts developing soon after its formation.

• On the basis of development of zygote, animals may be either **oviparous** or **viviparous**.

In oviparous animals like reptiles and birds, the fertilised eggs covered by hard **calcareous shell**.
Embryonal protection and care are better in viviparous organisms.

• In flowering plants, after fertilisation, ovary develops into fruit and ovules mature into seeds.
After dispersal, seeds germinate under favourable conditions to produce new plants.

