Reproduction in Organisms

Asexual Reproduction

- The period through which a certain organism lives is known as its life span.
- Reproduction is the process by which every organism ensures its continuity.
- It is the process through which organisms produce young ones, which in turn mature to give rise to their young ones.
- Reproduction can be:
- Asexual – Only one individual is involved
- Sexual – Two individuals (male and female) are involved

Asexual Reproduction

- In this type, a single parent can produce offspring.
- The produced offspring are clones of each other (i.e., identical to each other and to the parent).
- It is commonly seen in unicellular organisms belonging to protista and monera.
- Here, the cell division itself is the mode of reproduction.

Means of Asexual Reproduction -

- **Binary Fission** – In this process, the cell divides into halves, and each half develops into an adult (example: *Amoeba*, *Paramecium*).
- **Multiple Fission** - In this process, the cell divides into multiple cells. The individual cells remain encapsulated in a resistant coat (cyst walls) and are released after the rupture of these walls. This process is called sporulation and the encysted products are termed spores. The spores remain inactive during unfavorable conditions such as dessication and extremes of temperature. When condition becomes favorable, the cyst hatches and gradually grows into an adult.
- **Budding** – In this process, the cell divides unequally to form buds, which remain attached to the parent initially, and then detach and develop into a mature cell (example: yeast).
- **Fragmentation** - In this process, an organism splits into fragments. Each of these fragments develop into mature fully grown individual followed by mitosis (example: *Spirogyra*).
- Regeneration is a special type of process which helps in the renewal, restoration and growth of an organism. It can occur at the level of cells, tissue and organs. For example, a lizard can discard a

part of tail when in danger, and the tail can regenerate later. In humans too the liver can regenerate if partially damaged.

Formation of specialized structures

- Conidia – (Example: *Penicillium)*
- Gemmules – (Example: Sponges)
- Buds – (Example: *Hydra*)
- Zoospores – Microscopic, motile spores (Example: Algae)
- **Vegetative propagation** – It means of asexual reproduction in plants. Different structures are capable of giving rise to new plants.
- Runner – (Example: Gladiolus)
- Rhizome – (Example: Ginger)
- Sucker - (Example: Raspberry)
- Tuber – (Example: Potato)
- Offset - (Example: Aloe vera)
- Bulb – (Example: Onion)

Sexual Reproduction: Pre-Fertilisation Events

- Sexual reproduction involves the formation of the male and female gametes in either the same individual or two individuals. These gametes fuse to form a zygote, which develops into a new individual.
- Offspring are not identical to each other or to the parents. So, sexual reproduction gives rise to diversity among living organisms.
- All organisms pass through two stages.
- Juvenile phase/ Vegetative phase– Period of growth; non reproductive.
- Reproductive phase

- In non-primate mammals like rats, sheep, dogs, cows and tigers, the cyclic change in the activities of the ovaries and the oviduct is called the **oestrus cycle**; in primates like monkeys, apes and humans, it is called the **menstrual cycle**.

- Certain mammals are called **continuous breeders** since they can reproduce throughout their reproductive phase, while some are called **seasonal breeders** since they can reproduce only in the favourable seasons.

Events in Sexual Reproduction

- Organisms reproducing sexually exhibit certain events. These are:

- Pre-fertilisation events

- Fertilisation events

- Post-fertilisation events

Pre-Fertilisation Events

- Events taking place before the fusion of the gametes

- Consist of:

- Gametogenesis

- Gamete transfer

Gametogenesis

- Process of formation of gametes (male and female)

- Gametes are haploid

- In some organisms (like algae), they are almost similar (homo or isogametes), and cannot be categorised as male and female gametes.

- In others, the two gametes are morphologically and physiologically different (heterogametes), and are of two types—antherozoid or sperm (male gamete) and egg or ovum (female gamete).

- In some organisms both the sexes are present in the same individual (monoecious or homothallic), and in others, they are present in two individuals (dioecious or heterothallic).

> In a unisexual flower, the male flower is called staminate and the female flower is called pistillate.

- Gamete formation takes place by cell division.

    In haploid parents, it is by mitosis; in diploid parents, it is by meiosis, with specialised cells called meiocytes undergoing meiosis.

Gamete Transfer

- For their fusion to take place, the gametes need to be transferred.
- In most organisms, the male gametes are motile, while the female gametes are non-motile, and the male gametes need a medium for their movement. A large number of male gametes do not make it to the female gamete, and hence, several thousands of male gametes are produced to overcome this loss.
- In angiosperms, the pollen grain carries the male gamete and the ovule carries the female gamete.
- Pollen grains are produced in the anther and need to be transferred to the stigma for fertilisation to occur. This is easy in monoecious plants as both the anther and the stigma are present close by; in dioecious plants, it takes place by pollination.

Sexual Reproduction: Fertilisation Events

- Fertilisation is the most important event in sexual reproduction.
- This process is also called **syngamy** and leads to the formation of the zygote.
- However, in some organisms, zygote formation takes place without fertilisation, and is known as **parthenogenesis** (occurs in rotifers, honeybees and some lizards).
- In most aquatic organisms and amphibians, fertilisation takes place outside their body (in the water), and is termed as **external fertilization**.Their eggs and offspring are highly vulnerable to predators and this threatens their survival up to adulthood.
- In most terrestrial organisms, fertilisation is internal, i.e., it takes place inside the female body. In this process, the male gamete is motile and reaches the female gamete to fuse with it, thereby forming zygote. Male gametes are produced in large numbers.

Sexual Reproduction: Post-Fertilisation Events

- Events taking place after fertilisation are called post-fertilisation events.

Zygote

- The haploid gametes fuse to form a diploid zygote in all organisms.
- In external fertilisation, a zygote is formed in an external medium, and in internal fertilisation, a zygote is formed inside the individual.
- The development of a zygote depends upon the life cycle of an organism and its surroundings. In some organisms, the zygote does not develop immediately, and develops a thick wall around itself. This wall is resistant to damage and desiccation.

Embryogenesis

- It is the process of development of the embryo from the zygote.
- The zygote undergoes cell division and differentiation.
- Cell division increases the number of cells of the embryo, and cell differentiation helps the cells undergo modifications to form specialised tissues and organs.
- Animals can be grouped into two categories based on how and where the development of the zygote takes place. These categories are:
- **Oviparous** – The fertilised egg is covered by a calcareous shell and is released into the outside environment. The development takes place inside the egg and the young one hatches out (example: birds and reptiles).
- **Viviparous** – The development of the zygote takes place inside the female body, and the developed young one is delivered outside (example: mammals, including humans).
- In flowering plants, the zygote is formed inside the ovule.
- Zygote → Develops into → Embryo
- Ovule → Develops into → Seed
- Ovary → Develops into → Fruit → Contains → Seeds → Disperse and germinate to form new plants.