Ch- 8
Reproduction

Reproduction: It is a biological process in which an organism maintains the generation of its kind.

Importance of Reproduction:
1. It maintains population
2. It maintains genetic pool of species
3. It creates variation, which provides survival advantage to the species
4. It maintains diversity
5. It supports in evolution
6. It prevents extinction of species

Types of Reproduction:
1. Asexual reproduction: A mode of reproduction in which gametes are not involved. It is known as asexual reproduction, for example, amoeba, Hydra, planaria, etc.

2. Sexual Reproduction: A mode of reproduction in which gametes are involved. It is known as sexual mode of reproduction, for example, human beings, cats, etc.

Basic features of Asexual Reproduction:
1. It is a uniparental system
2. The same DNA copying takes place
3. There is no involvement of gametes
4. Individuals are identical to their parents
5. There is no variation
6. They do not support evolution
7. It is a rapid mode of reproduction
ASEXUAL REPRODUCTION

Fission: A process of asexual reproduction in which parent cell divide into two or more parts & form new individuals. The process is called fission, for example Amoeba, Paramaecium, Euglena, Leishmania etc.

Types of fission:

(i) Binary fission - A process of fission in which parent cell divide into two parts & each part form new individuals. The process is known as binary fission. The parent disappears as its body gets distributed into its daughter daughters.

- Daughters are identical to their parents.
- In paramaecium, the plane of division is transverse.
- In case of Euglena & Leishmania, the plane of division is vertical.
- Binary fission occurs under favourable conditions.

(ii) Multiple fission - It is a mode of fission in which unicellular parent divides & splits internally to form a no. of daughter individuals.

- Plasmodium (malaria parasite) under unfavourable condition divides repeatedly to form a no. of daughter nuclei. After that, the cytoplasm gathers around each nucleus to form daughter cells. The parent cell bursts, its cyst (outer covering) & release the daughter individuals inside red blood cells.

- Amoeba also participate in multiple fission.
Step of fission →

1. Division of nucleus
2. Distribution of cytoplasm
3. Cell stretches & divides according to no. of nucleus and form new individuals.

<table>
<thead>
<tr>
<th>Binary fission</th>
<th>Multiple fission</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) It gives rise to two new</td>
<td>1) It divides more than two</td>
</tr>
<tr>
<td>individuals.</td>
<td>parts and form many individuals.</td>
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<tr>
<td>2) It takes place under</td>
<td>2) It takes place both under</td>
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<tr>
<td>favourable condition.</td>
<td>favourable &amp; unfavourable conditions.</td>
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<tr>
<td>3) Nucleus of parent cell</td>
<td>3) Nucleus of the parent undergoes</td>
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<tr>
<td>divides only once, to form two</td>
<td>repeated division &amp; form a</td>
</tr>
<tr>
<td>daughters.</td>
<td>no. of daughter nuclei.</td>
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<tr>
<td>4) No part of parent body is</td>
<td>4) Sometimes a residual</td>
</tr>
<tr>
<td>left.</td>
<td>cytoplasm is left behind.</td>
</tr>
<tr>
<td>5) For example, amoeba,</td>
<td>5) For example, Alasmodium,</td>
</tr>
<tr>
<td>Paramecium, Ichthymaniet,</td>
<td>amoeba, etc.</td>
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*Mini-cellular organisms*

Budding: Budding is the formation of an outgrowth from an organism which separates to produce a new individual. For example, yeast.

- Yeast is a unicellular fungus which is widely used in baking industries and in fermentation process.
- During its growth, each individual produces a small bud. The nucleus present in parent cell now divides. One nucleus passes into bud. The bud grows in size & finally detach from parent's body & form new individual.
A single yeast cell may produce 1, 2 or 3 buds which may further bear buds. All these may remain attached for sometime. The condition is called torulose stage. When they get mature, they detach from parent's body to form many new individuals. This process is also known as chain budding.

Budding in unicellular organisms is slightly different from binary fission.

i) In case of binary fission, parent cell disappears and formation of two new individuals.

ii) In case of binary fission, nucleus divides before the formation of daughter cells.

iii) In case of budding in unicellular organisms, the parent cell remains intact & does not disappear & form new individuals. Nucleus divides after the formation of bud.

Budding in Multi-cellular organisms:

It is a mode of reproduction in which one or more outgrowths develop from the body of an organism which then separate from the parent body to form new individuals. Repeated cell divisions at a specific site give rise to cellular mound which grows & form a bud. For example: Hydra, it multiplies by budding under favourable conditions. The bud generally develops from the lower half of its body. It grows in size. Mouth & tentacles are formed terminally, as soon as the bud becomes mature, it detaches from parent's body to form new individual.
A few cases of hydra & other multicellular organisms who reproduce through budding have stem cells which form buds by the process of repeated division.

**Fragmentation:** It is the process of breaking of the body of an organism into two or more parts called fragments, each of fragment grows into a new individual & this process is called fragmentation.

- It is found in algae, fungi, bryophytes & some marine ribbon worms.
- It is caused by following reasons:
  1. Mechanical disturbance
  2. Chemical action
  3. Death & decay of older parts

**Regeneration:** It is the ability to repair injured parts & replace the ones lost through an accident.

- It is helpful in multiplication of some animals like hydras & planaria. If they are broken or cut into pieces, each piece grows the missing part & forms the complete organism.

**Regeneration** is due to presence of stem cells. These cells proliferate & forms a large no. of cells. Cells then undergo differentiation giving rise to various cell types & tissues in an organized manner. Just like development or growth of an individual to form new organisms.
Regeneration: It is not similar to reproduction because organisms regain their lost body part & form complete organisms.

Higher animals have limited power of regeneration.
For example:
(i) Tail in lizard
(ii) Arm in starfish.

In case of starfish & lizard, the development and differentiation is controlled by nervous & hormonal system.

Spore formation: Spores are very minute unicellular asexual reproductive bodies which get dispersed & form new individuals on germination. For example: bacteria, algae, fungi, protists, etc.

Rhizopus (bread mould) multiply their generation by the process of spore formation. The Rhizopus has a net of threads like structure called hyphae. Some of the hyphae bear bulb-like structure called sporangium. Each sporangium contain lot of spores inside it. The cell of the mature sporangium (cyst) cracks opens and release spores in the air which get dispersed and fall on ground, it get required condition & again form hyphae.

Vegetative Propagation:

It is a process of formation of new plants from the vegetative parts of plants like leaves, roots, stems etc.

OR

The practice of growing new plants without using seeds is known as vegetative propagation.
There are two types of vegetative propagation:

(i) Natural methods of vegetative propagation: These are methods of plant multiplication with the help of vegetative parts of plants that occur naturally. For example:
- Roots: Roots of some plants develop into buds which grow & form new plants like poplar, dahlia, sweet potato etc.
- Stems: Stems of some plants have the ability to grow into new plants like runners, ginger, turmeric, potatoes etc.
- Leaves: The leaves of some plants bear buds which form new plants like Bryophyllum.
- Buds: Some parent plant contain buds which give rise to new plants like banana, axalis etc.

(ii) Artificial method of vegetative propagation:
These are methods of rapid multiplication of plants with the help of vegetative parts which have been developed artificially.

The best period for artificial propagation is spring & rainy season.

There are three methods of artificial vegetative propagation:

- Cutting: They are small pieces of stems, roots & leaves which are cut off from the plants & used as vegetative parts. For example, raspberry, sugarcane, rose plant, Bougainvillea etc.
- Layering: It is mostly practised in ornamental plants like jasmine, morgan, orchid etc.
- Grafting: It is a technique of joining short system of one plant onto the another related plant so as to form
a composite for plant that grows as a single plant for example, orange, lemon, rose, mango, etc.

Advantages of Grafting:

1) Better growth of varieties with poor root system.
2) Growing new varieties locally.
3) Obtaining quicker & better yield of desired flower & roots.

Advantages of Vegetative Propagation:

1) Vegetative propagation is the only known method of multiplication of seedless plants like banana, sugarcane, jasmine, etc.
2) Seeds & fruits are of uniform quality, size, taste & aroma.
3) Good quality of variety variety can be maintained.
4) Survival rate of the daughters is nearly 100%, while in case of seed grown plants, it is 1-10%.
5) Vegetatively reproduced plants bear flowers & roots earlier than the plants raised through seeds.
6) In areas where seed germination fails to form mature plants, vegetative reproduction can help in establishing the plants.

Disadvantages of Vegetative propagation:

1) They cannot be stored for a long.
2) Diseases spread from parents to all the daughters.
3) Due to absence of variation, asexually reproduced organisms are unable to adapt themselves to changes in the environment.
**Tissue Culture:** (Micro propagation)

Tissue culture is a method of raising new plants from small pieces of plant tissue over a culture or synthetic medium under specific conditions.

**Importance of DNA copying:**

1. DNA brings all the parental information from parents to their next generation.
2. All the development of the cell take place on the behalf of parental informations.
3. In case of asexual reproduction same DNA copying takes place. That’s why variation is absent.
4. In case of sexual reproduction different DNA copying takes place. That’s why the chances of variation is very high.
5. Cell multiplication cannot occur without DNA copying.
6. DNA determines the body design of individual.

**Importance of Variation:**

Many of the variations are pre-adaptations which have no immediate benefit to the individual but they remain in the population. Whenever, environment undergoes a drastic change, the pre-adaptations present in some members of the population allow the organism to survive, grow & regain their population size. Therefore, it is not necessary that variations are benefitted to the individuals but useful to the species.