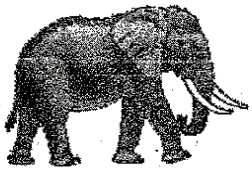
REPRODUCTION IN ORGANISMS
ASEXUAL REPRODUCTION

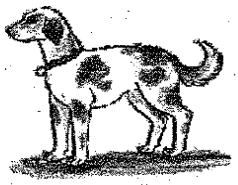
REPRODUCTION IN ORGANISMS

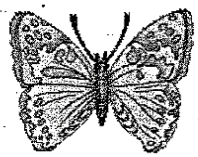
INTRODUCTION

- Every organism lives for a certain period of time.
- The **life span** is the period from birth to the natural death of an organism.
- It roughly tells us, how long a particular species of an organism, can live.
- As life span is an average value, you will always have some exceptions i.e. a few members of a species exceeding their life span. This is called as **maximum life span**.
- The life span of some organisms might seem very short while of others are reasonably long, when compared to organisms of different species.
- **The life spans are not necessarily correlated with the body size** of organisms e.g. the body sizes of crow and parrot are not very different yet there is a great difference between their life span.
- The genetic makeup, metabolic rate, body size, age at sexual maturity and several other factors like habitat, quality of food, competitions, environmental conditions etc., collectively determine, the life span of an organism.

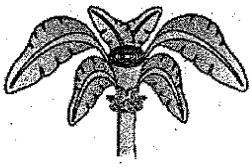

Elephant (65-90 years)

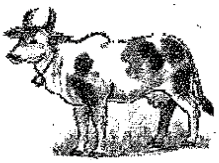

Rose (5-7 years)

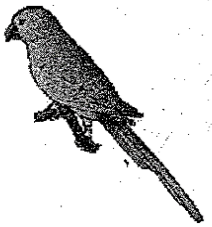

Dog (**20**-30 years)

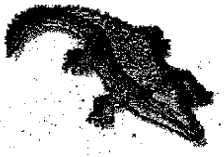

Butter fly (1-2 weeks)

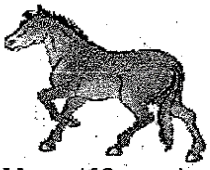

Crow (15 years)

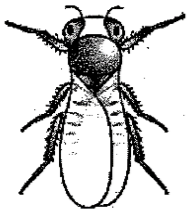

Banana tree (20-25 years)

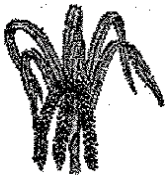

Cow (**15**-25 years)


Parrot (140 years)


Crocodile (60 years)


Horse (62 years)


Fruit fly (about **20**-30 days)


Rice plant (3-4 months)


Tortoise (100-150 years)


Banyan tree (**200**-300 years)

Approximate life spans of some organisms

Reproduction

- Inspite of variations in the life span of organisms, death is certain except single celled organisms (e.g. *Amoeba*), Let us think, how organisms of different species are successfully continuing their existence, over thousands of years, although their life spans are limited and death is certain? Definitely, there is
- **Reproduction** is defined as a biological process in which an organism gives rise to young ones (offspring) similar to itself. The offspring grow, mature and in turn produce **new offspring**. Thus, there is a cycle of birth, growth and death.

- Reproduction enables the **continuity of the species,** generation after generation.

- In the biological world, it may not be surprising to you, that different organisms have evolved different strategies for reproduction.

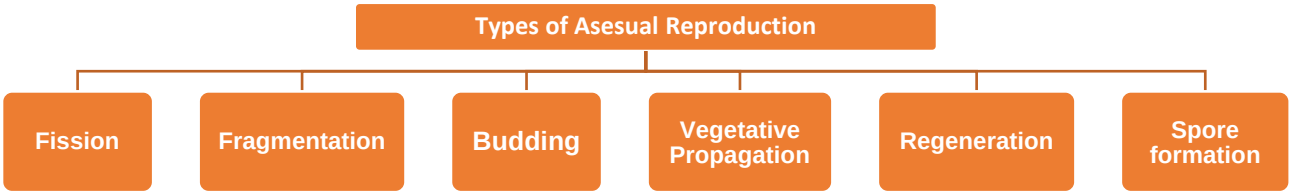
- Of course, it is due to the occurrence of variations in structure, physiology and habitat of organisms. In broad sense, there are two basic types of reproduction: asexual and sexual.

- **Asexual reproduction** does not involve gamete formation and fusion. It is rapid, uniparental and less energy consuming, as there is no search, either for mate or for fertilization.

ASEXUAL REPRODUCTION

- In this method, a single individual (parent) is capable of producing offspring. As a result, the offspring that are produced are not only identical to one another but are also exact copies of their parent.
  Are these offspring likely to be genetically identical or different? Answer will be **genetically identical**.
- A group of genetically identical offspring produced from single parent is called **clone**. Each member of a clone is termed as **ramet**.

- The members of a clone can however, differ morphologically due to the impact of environmental conditions.
- Many single-celled organisms (monerans and protists) reproduce by **binary fission**.
- Member of kingdom fungi and algae reproduce through special asexual reproductive structures called zoospores.

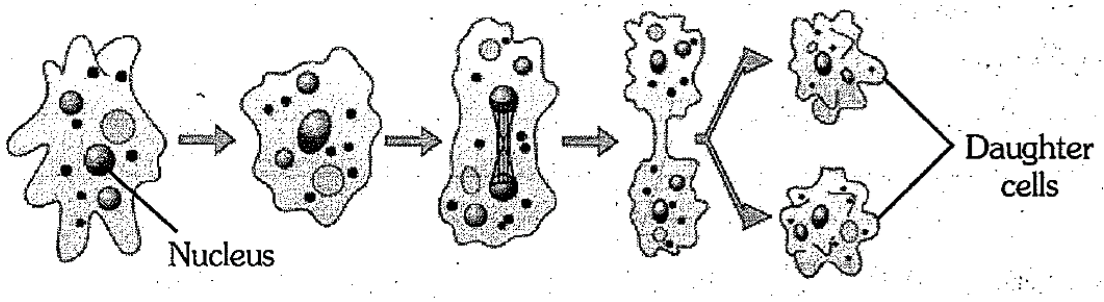


Fission

- Conidia (Penicillum) buds (Hydra) and gemmules (sponge) are other common asexual reproductive structures
- In this mode of asexual reproduction, the body of parent individual, divides into two or more, similar and equal sized daughter individuals.
- Single celled organisms (e.g. protists and monerans) reproduce by this mode of asexual reproduction. Fission may be binary fission or multiple fission.

(a)Binary fission

- In this type of fission, the parent individual divides into two equal halves, each of which becomes an independent daughter individual.



(Binary fission in Amoeba)

- The binary fission involves all the steps of mitosis e. g. karyokinesis and cytokinesis.
- Depending upon the plane of division, it may be irregular or asymmetric, transverse and longitudinal.

1. Longitudinal binary fission

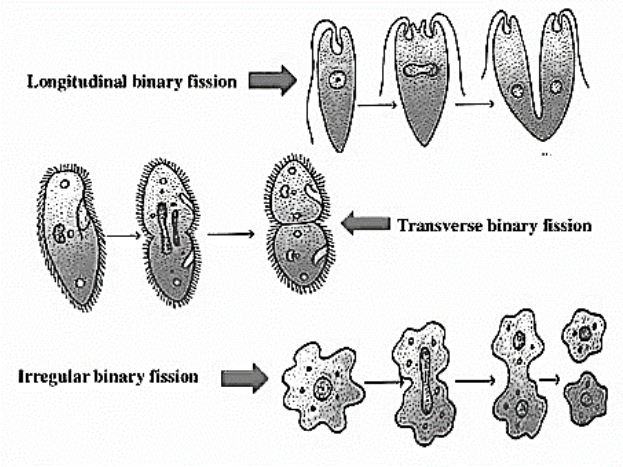
The plane of fission passes along the longitudinal axis of the animals e.g., Euglena, Vorticella.

2. Transverse binary fission

The plane of binary fission runs along the transverse axis of the individual, e.g., Paramecium

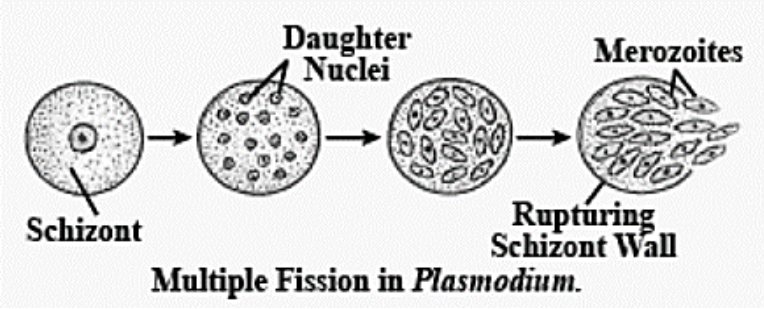
3. Irregular(Asymmetric) binary fission

The plane of binary fission is uncertain e.g., Amoeba



(b)Multiple fission:

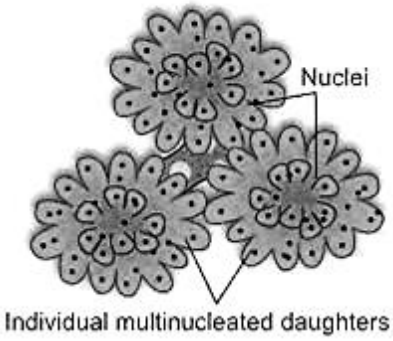
- In this type of fission, nucleus divides several times, by mitosis to produce many nuclei, **without involving cytokinesis.**
- Subsequently, each nucleus gathers, a small amount of cytoplasm around it and the parent individual splits into many small daughter cells (e.g. *Amoeba*, *Plasmodium*, *Monocystis*).
- In due course of time, each of these daughter cells, starts a free life and transforms into an adult individual.



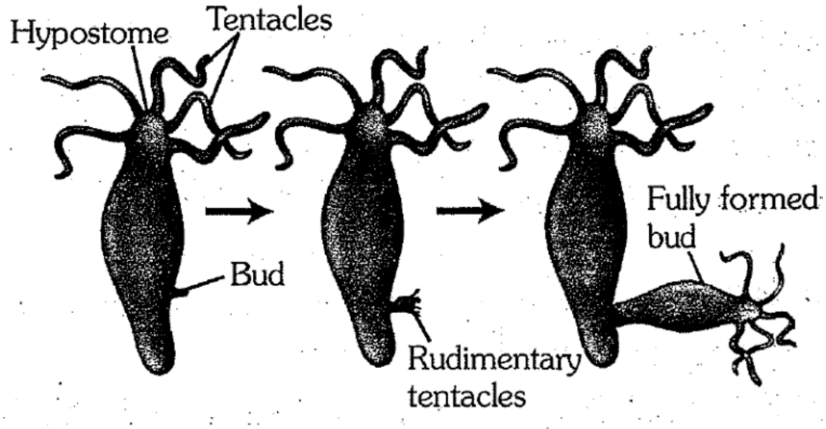
Multiple Fission in *Plasmodium*.

- Plasmotomy

It is the division of a multinucleate protozoan into multinucleate daughter individuals by cytoplasmic division but without nuclear division e. g. Opalina.



- BUDDING
- This mode of asexual reproduction is exhibited by some multicellular organisms of simple organisation e.g. **Hydra** and some single celled eukaryotic forms e.g. **yeast**.
- In budding, initially, a small **external outgrowth** appears over the parent's body, which later develops into a miniature individual.
- It, then separates, from the parent's body, to lead an independent life

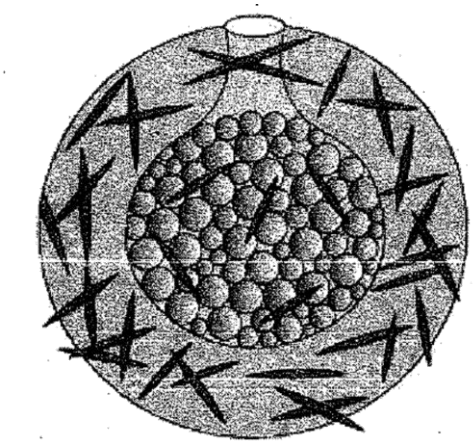


(Budding in Hydra)

Gemmule Formation :

- In most of, the fresh water sponges (e.g. Spongilla) and some marine sponges (e.g. Sycon), the parent individual produces a specialised mass of cells enclosed in a common opaque envelope to form **gemmule.**
- On germination, each gemmule gives rise to a daughter individual.
- The **archaeocytes,** present in the gemmule, divide and transform into various types of cells.

Gemmules are **internal bud.**



(Gemmule formation in Spong)

- VEGETATIVE REPRODUCTION IN PLANTS
- In vegetative reproduction, new plant arises from the vegetative part (e.g. stem, root and leaf etc.) of the parent plant.
- It is a form of asexual reproduction, as it doesn't involve genetic recombination and hence variations in the progeny.
- The new plants resulting from vegetative reproduction represent a clone.

Methods of vegetative reproduction in plants

There are two types of vegetative reproduction in plant

1. Natural method
2. Artificial method

1. **Natural method**

a. **Underground stem:**

- Axillary buds (in the axils of leaves on stem nodes) give rise to new plants
- e.g. **tuber** (e.g.potato), **rhizome** (e.g. banana, turmeric, ginger, fern), **corm** (e. g. Crocus, Colocasia, Amorphophallus), **bulb** (onion, garlic).

b. **Sub-aerial stem :**

- Shoot apex and stem nodes give rise to new buds.
- These buds detach from the parent plant and produce new plants.
- e.g. runner (grass), stolon (strawberry), sucker (e.g. Chrysanthemum, rose, mint), offset (e.g. Eicchornia).

c. **Leaves:**

- Adventitious buds develop into the notches of leaf margins and give rise to new plants.
- e.g. **Bryophyllum**, Adiantum (walking fern), Begonia etc.

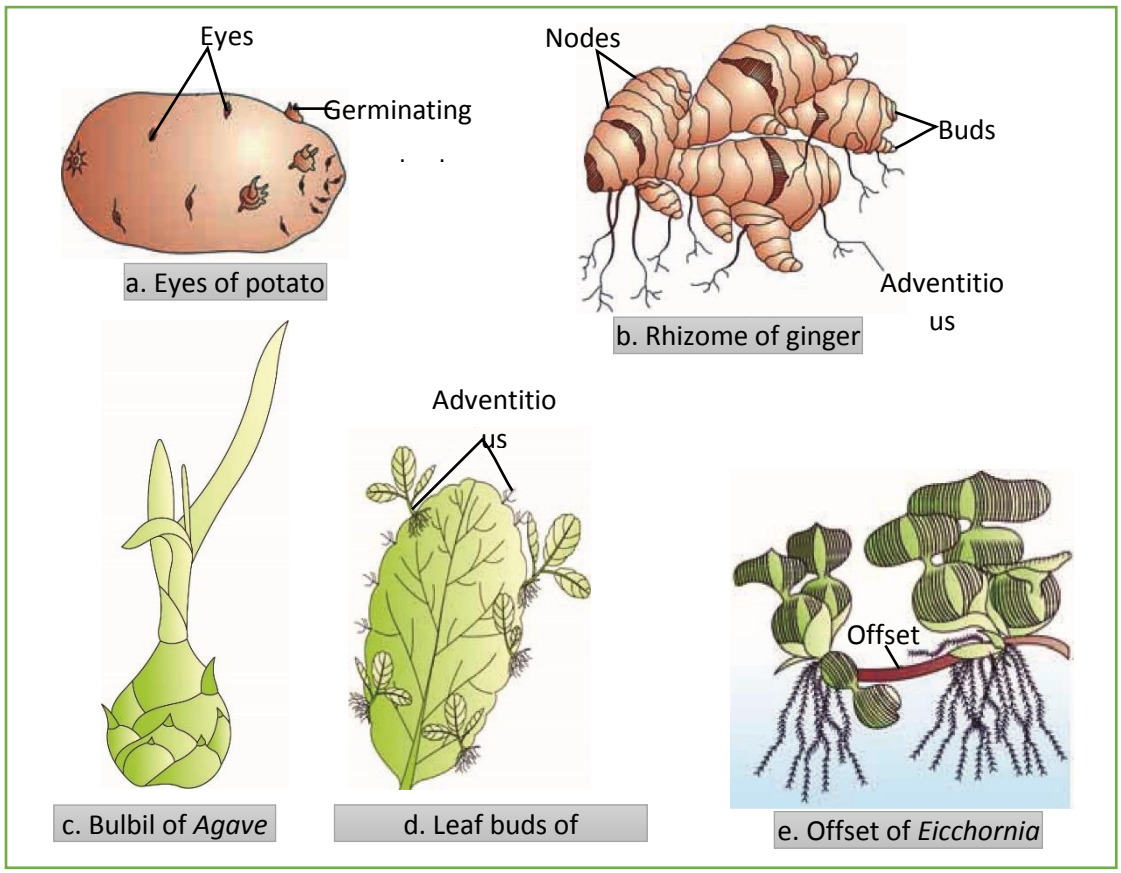
d. **Roots:**

- In some fleshy and tap roots, adventitious buds develop and give rise to new plants.
- e.g.guava, Dalbergia (shisham), **sweet potato**, dahlia, Asparagus.

e. **Bulbils:**

- These arise on fleshy axillary bud and behave as perennating bodies during unfavourable conditions.
- In suitable environmental conditions they detach from the parent plant and give rise to new plants.
- e.g.**Agave,** Aloe, Oxalis, Dioscorea.

Vegetative Propagule	Example
Root	**Dahlia**
Stems	
⇒ **Tubers**	Potato
⇒ **Bulbs**	Garlic and onion
⇒ **Rhizome**	Ginger, turmeric, banana
⇒ **Corms**	Colocasia
⇒ **Suckers**	Mint and Chrysanthemum
⇒ **Runners**	Oxalis
⇒ **Stolons**	Jasmine
⇒ **Offsets**	Pistia and Eichhornia
Leaves	Bryophyllum
Bulbils	Agave



a. Eyes of potato

b. Rhizome of ginger

c. Bulbil of *Agave*

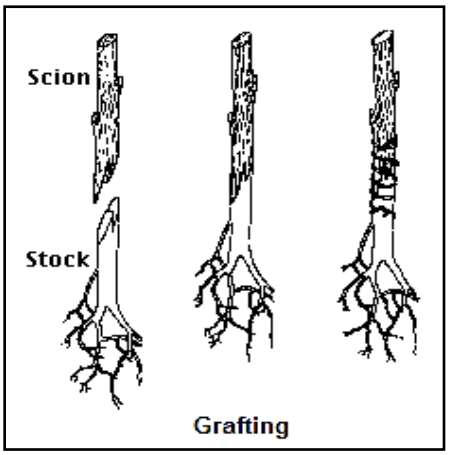
d. Leaf buds of

e. Offset of *Eicchornia*

2. Artificial method

a. Grafting :

- It is an artificial form of vegetative propagation, in which, parts of two young plants are joined together, first by artificial means and then by tissue regeneration.
- Typically, a twig or bud is cut from one plant and joined to a rooted plant of a related species or variety.
- The twig or bud is called the **scion**, and the plant onto which it is grafted (and that provides the roots) is called the **stock**.
- The scion eventually develops into an entire shoot system.
- It often allows horticulturalists to combine the best features of the two different plants into one plant. It can only be performed in dicotyledonous plants.



b. Cutting

- A plant cutting is a piece of a plant that is used in horticulture for vegetative (asexual) propagation.
- A piece of the stem or root of the source plant is placed in a suitable medium such as moist soil.
- If the conditions are suitable, the plant piece will begin to grow as a new plant.

c. Layering

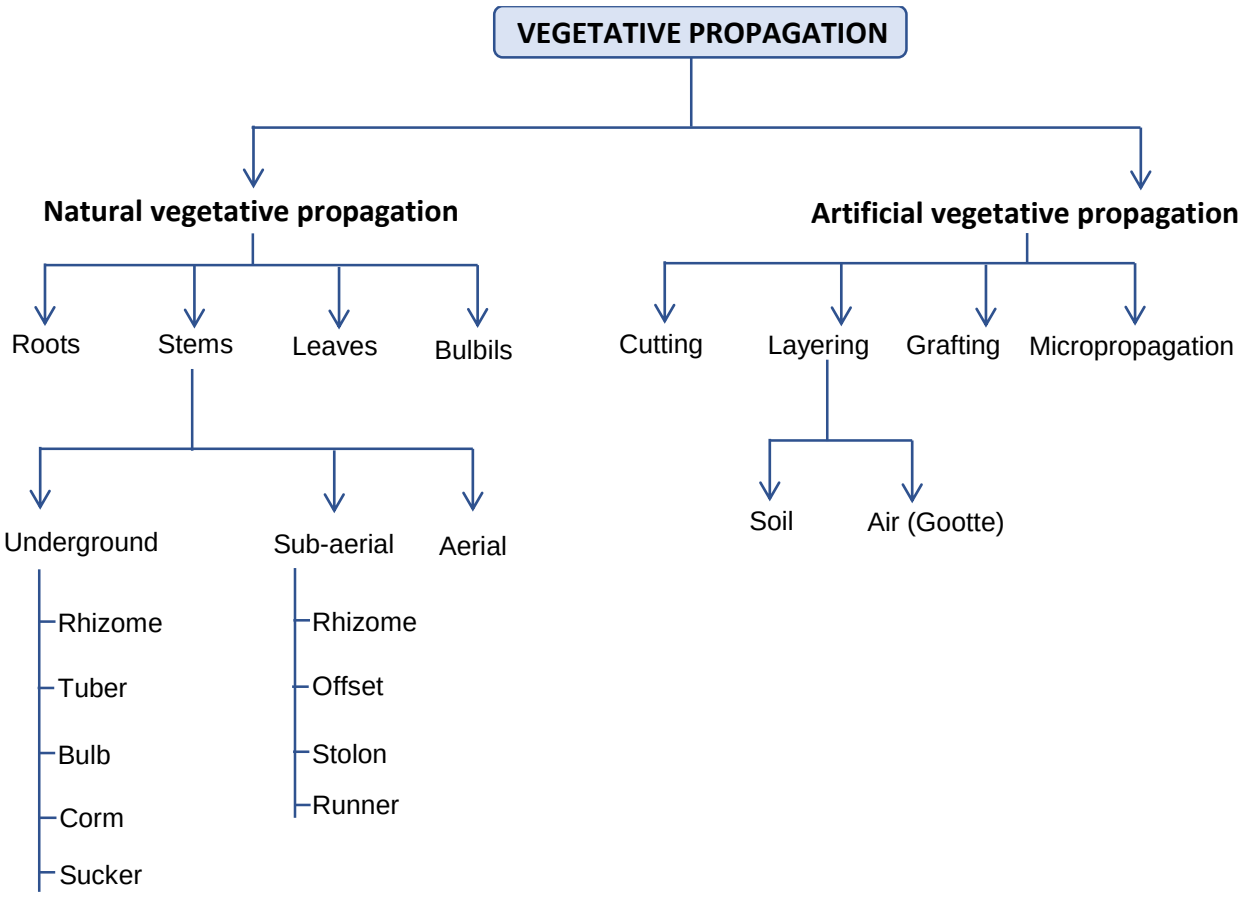
- It is horticulture technique of vegetative propagation in which a one year old shoot is first induced to develop roots and then cut off to form new plant. It is also, therefore, called rooting-cutting.
- The timing is early spring or rainy season. A middle part of the shoot is defoliated and given a small injury in the form of **ringing** (removal of bark in the form of a narrow ring), **notching** (a narrow V-like cut) or **tongueing** tongue – like cut).
- It is then curried and pegged down in the soil with the foliage bearing apical part remaining above ground in near vertical position. The injured pegged down shoot is called **layer**.

d. Micropropagation or Tissue culture

- It is also called micro cloning or clonal propagation, is the vegetative propagation of plants by tissue culture techniques, using cells, tissues, organs, etc.
- Essentially, it involves the regeneration of plants from isolated meristematic or somatic cells or tissues.
- It provides a rapid and reliable means for the mass production of genetically similar and disease-free plants through the culture of the shoot – apices, axillary buds, and meristems.

Practice problems-

1. Define grafting.
2. Give some examples of vegetative propagagtion by roots.
3. What is micropropagation?
4. What are artificial methods of vegetative propagagtion?
5. Define layering.


VEGETATIVE PROPAGATION
Natural vegetative propagation
Artificial vegetative propagation
Roots
Stems
Leaves
Bulbils
Cutting
Layering
Grafting
Micropropagation
Soil
Air (Gootte)
Underground
Sub-aerial
Aerial
Rhizome
Tuber
Bulb
Corm
Sucker
Rhizome
Offset
Stolon
Runner