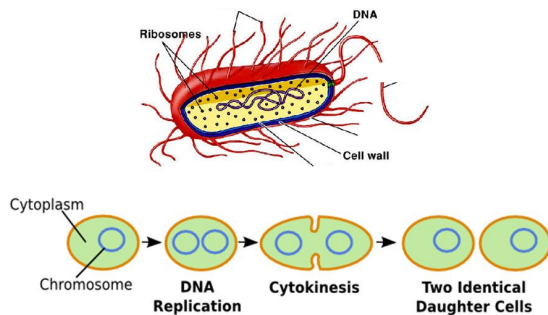


Examples of Asexual Reproduction

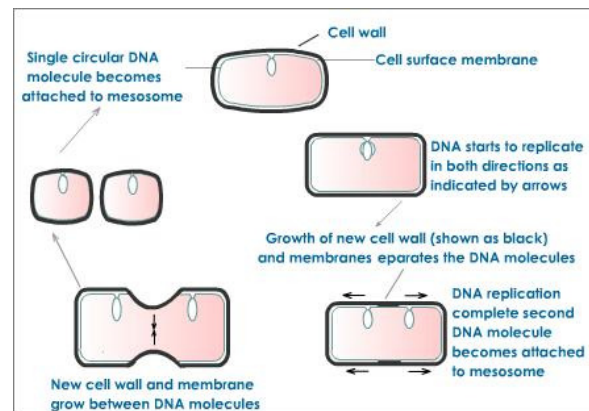
Binary Fission

Fission occurs in lower plants and animals such as the bacteria, blue-green algae and protozoa. In this process, the cell divides after the genetic material has divided. If the cell divides into two it is called binary fission. The DNA or the nucleus of a mature cell divides first and then the cell divides into two daughter cells of almost the same size. It is seen in bacteria and protozoans like amoeba and paramoecium.

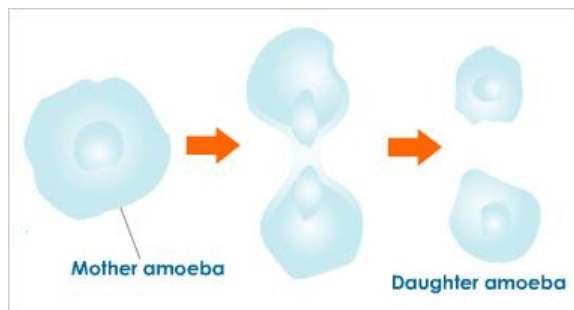
Binary Fission in Prokaryotes



Binary Fission in a Bacterium



Binary Fission in Amoeba

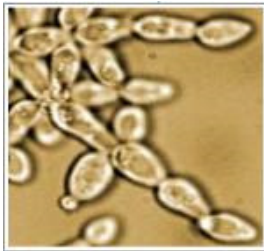


If the parent cell divides into many daughter cells, it is called multiple fission. It is seen in the life cycle of the protozoa, plasmodium (the malarial parasite). The nucleus divides many times and then the cytoplasm divides and surrounds the nuclei.

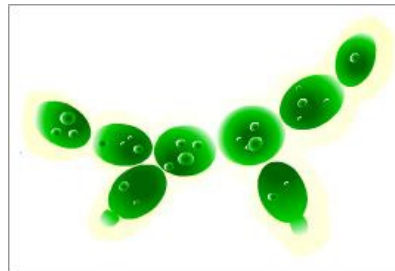
Budding

It is seen in certain fungi and multicellular animals. In budding, the parent cell or body gives out a lateral outgrowth called the bud. The nucleus divides and one of the daughter nuclei passes into the daughter cell. The bud grows in size while being attached to the parent body. It then gets separated from the parent by the formation of a wall. It then falls off and germinates into a new individual. Thus budding results in the formation of daughter cells of unequal sizes that later grow to adult size. For example, yeast, a fungus and Hydra, a multicellular animal. In case of Hydra, the daughter hydra even develops hypostome and tentacles develop around the hypostome before being detached from the parent body.

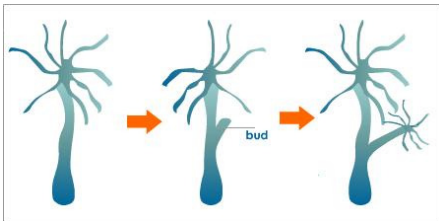
Budding Cells



Yeast Cells



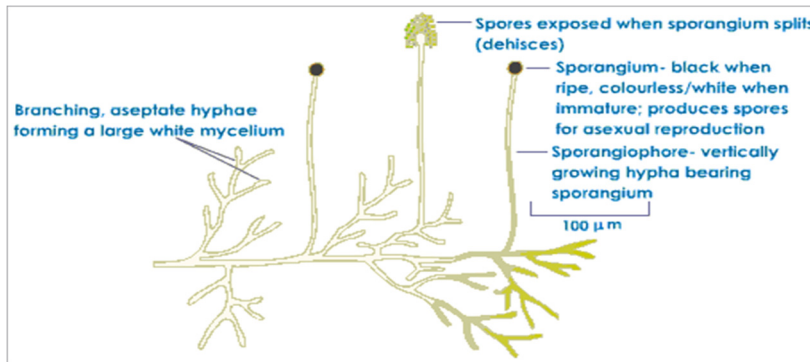
Budding in Hydra



Spore Formation

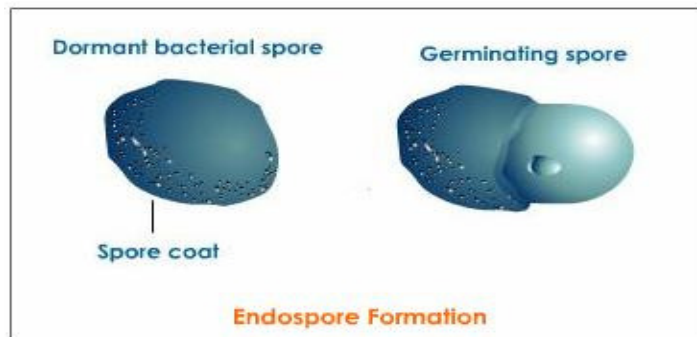
It is generally seen in bacteria and most fungi. One of the cells enlarges and forms the sporangium (literally meaning spore sac). The nucleus divides many times and then the daughter nuclei are surrounded with protoplasm bits to form daughter cells called spores. The spores are covered with a thick wall called the cyst. On maturation, the sporangium bursts and releases the spores. The spores germinate on getting favourable conditions. For example, fungi such as *Mucor* and *Rhizopus*

Mycelium of Mucor as seen with Low Power of a Light Microscope



Spore formation also occurs in bacteria such as *Clostridium* and *Bacillus*. The bacterial spores are also called endospores. They are thick-walled and lightweight.

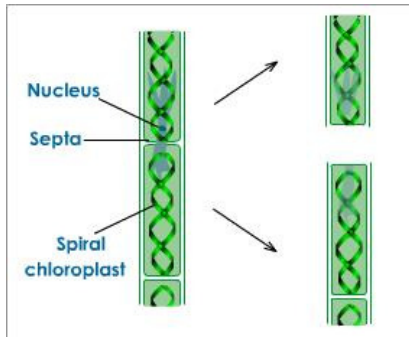
Endospore Formation



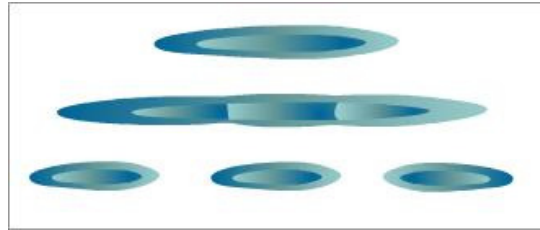
Fragmentation

It takes place in some lower plants and animals such as some worms. The mature organism breaks up into two or more pieces or fragments. The fragments then grow into complete organisms.

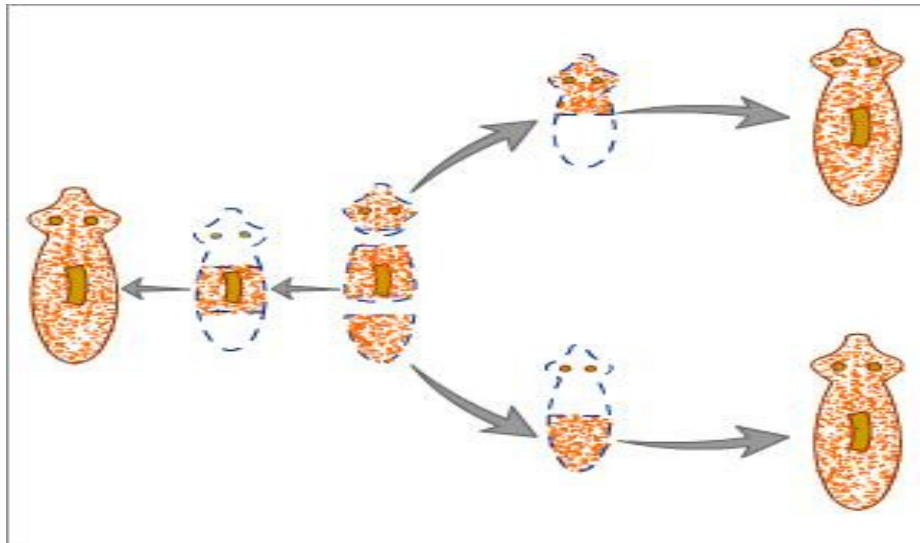
For example: Spirogyra, an alga.



Worms such as ribbon-worms and flatworms.



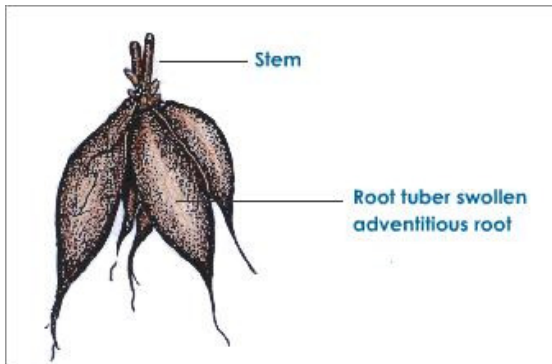
Fragmentation takes place in hydra, planaria and sponges. The fragments regenerate to form an entire individual.



Vegetative propagation

Regeneration of new plants from the vegetative parts of the parent plant is called vegetative propagation or vegetative reproduction. Vegetative propagation is done with the help of vegetative parts such as roots, stem or leaves. These parts may also be variously modified for vegetative propagation. Natural vegetative propagation is of different types based on the vegetative organ involved.

Vegetative Propagation by Roots - Roots of some plants develop new plants either by directly producing shoots or producing buds. Shoots are produced by roots of woody plants like *Dalbergia*, *Murraya* etc. Adventitious buds are formed on the roots of plants like sweet potato, dahlia, asparagus, tapioca, etc. These buds detach from the root and develop into new plants.



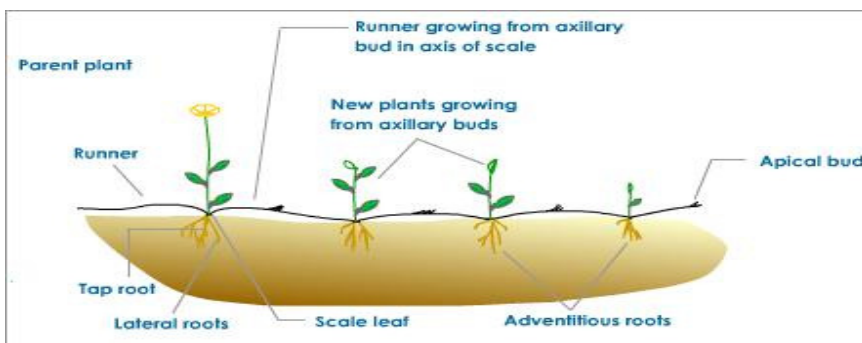
Root Tubers of Dahlia

Vegetative Propagation by Stem - Stem has nodes and internodes. The nodes develop leaves. In the axils of the leaves buds develop called the axillary buds. They develop into new plants on detachment from the parent plant or even when the stem portion remains attached.

There are different types of stems for vegetative propagation. They are:

Subaerial Stems - The branches that arise from the stem which is very close to the surface of the ground break off from the parent plant and develop new plants. These branches are classified as follows:

Runners - For example, strawberry, grass, etc.

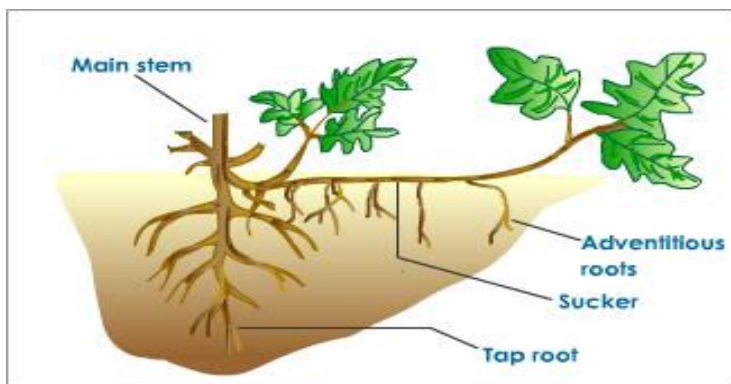


Strawberry Runner

Suckers - For example, mint, Chrysanthemum



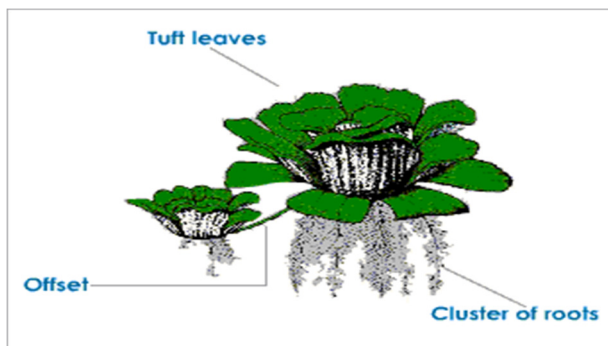
New Plants from Sucker of Mint



Vegetative Propagation by a Sucker of Chrysanthemum

Stolon - For example, gooseberry, jasmine, etc.

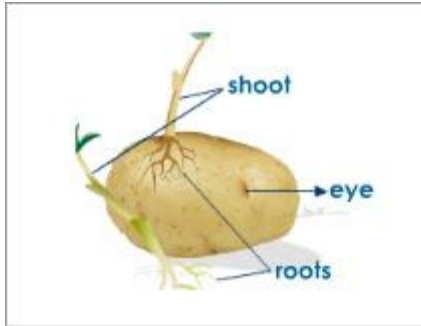
Offset - For example, Eichhornia (water hyacinth), Pistia, etc.



Vegetative Propagation by an offset of Water Lettuce (Pistia)

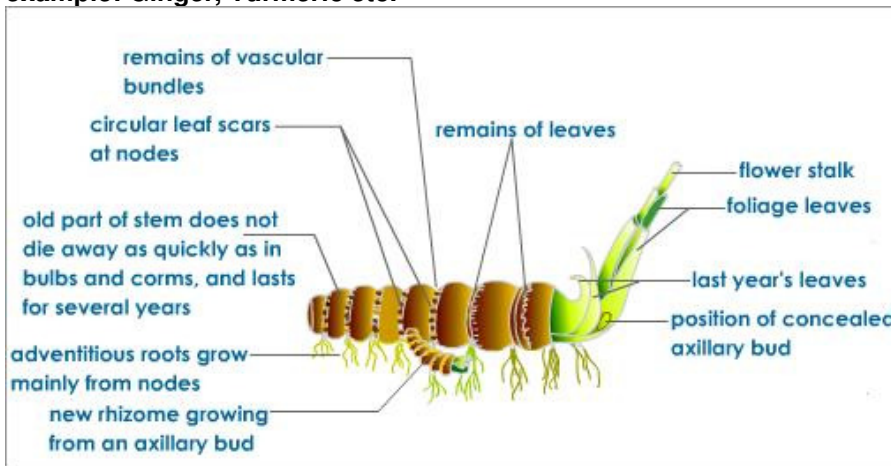
Underground Stem - The portion of the stem that is underground, in some plants, serves two functions. It tides over unfavourable conditions by storing food and becoming dormant and then germinating with the help of axillary buds when there are favourable conditions. The underground stems may be variously modified into the following kinds:

Tubers- The stem is swollen and the nodal regions are called the eyes. For example: Potato



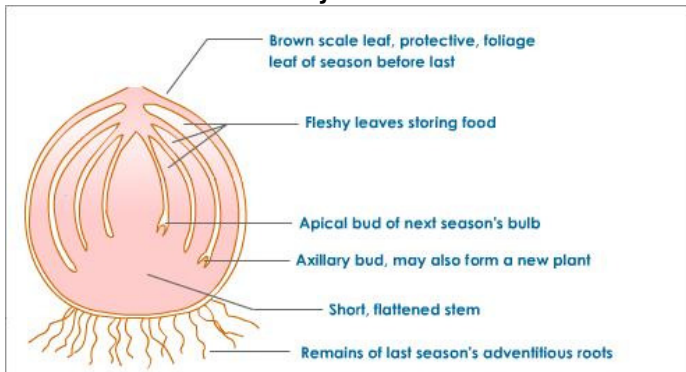
The Formation of Axils and Development of Aerial Shoots in Potato. Each eye has scaly leaves and axillary buds which develop into new plants when the tuber is planted.

Rhizomes - The stem is also swollen but it is branched. The scaly leaves are bigger. For example: Ginger, Turmeric etc.



Diagrammatic Structure of an Iris (Rhizome). Rhizomes also give rise to new plants from the axillary bud.

Bulb - The stem is very small and disc-like. For example: Onion, Garlic, Lilies, etc.



Diagrammatic Section through a Dormant Bulb. From the stem arise scaly and fleshy leaves which bear buds in their axils.

Corm: The stem is very similar to tuber but they do not have definite shape. For example: **Amorphophalus, Colocasia, Gladiolus, saffron, etc.**



Vegetative Propagation by Underground Corm

Vegetative Propagation by Leaves

This is not very common and is seen in plants such as Bryophyllum.



Totipotency Exhibited by Bryophyllum It has succulent (fleshy) leaves and adventitious buds are present at the margins of the leaves. These buds fall off and grow into new plants.