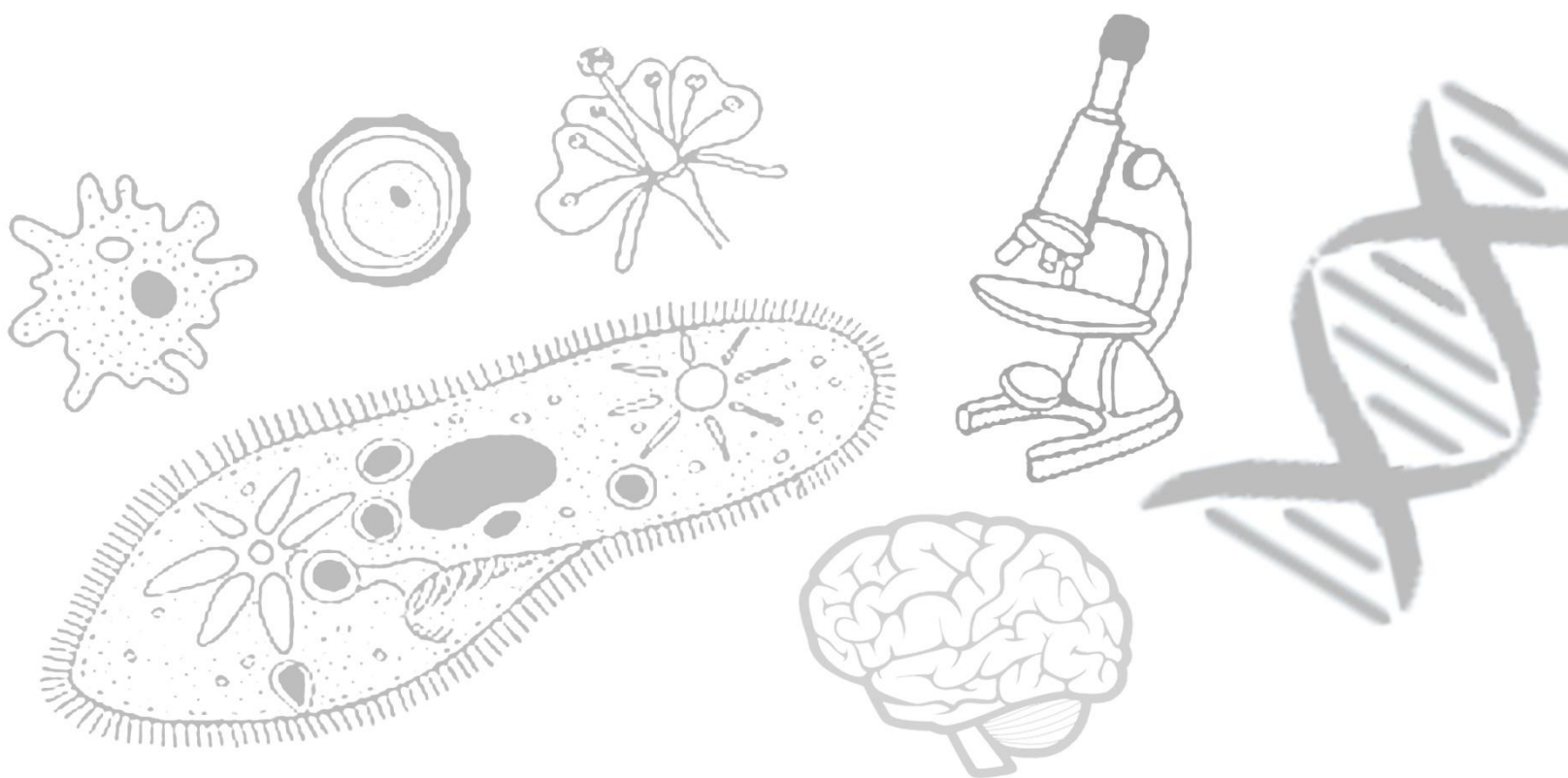


# BIOLOGY



## Artificial Vegetative Propagation

There are two principles to improve the quality and quantity of products:

- **By growing the desired variety of plants in large numbers**
  - Vegetative propagation
    - ❖ Natural vegetative propagation
    - ❖ Artificial vegetative propagation
  - Micropropagation
- **By evolving new varieties of plants with desired characteristics**
  - Hybridisation
    - ❖ Cross pollination
    - ❖ Somatic cell hybridisation

### Vegetative Propagation


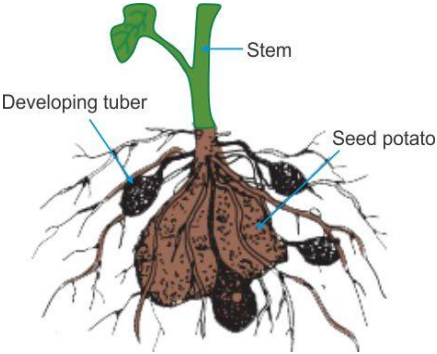
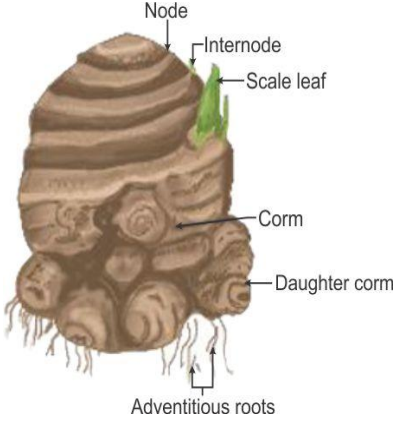
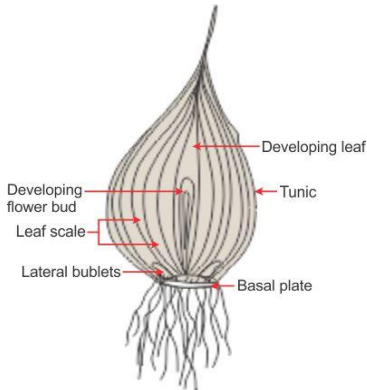
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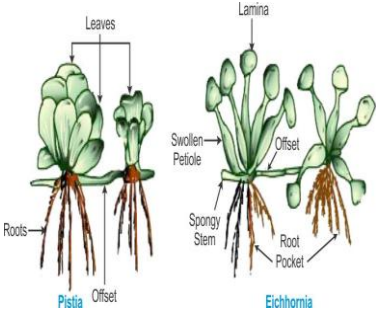
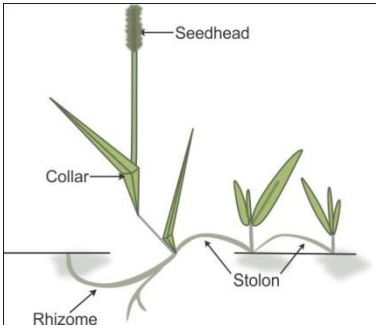
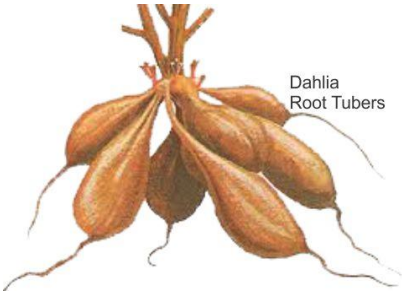

- Vegetative propagation or vegetative reproduction is a form of asexual reproduction in which relatively large, differentiated part of the plant's body gets detached from the parent plant and develops into an independent plant.

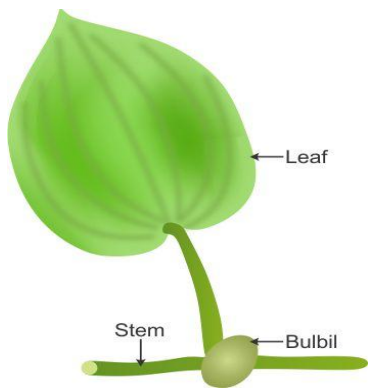
### Differences between Sexual Reproduction and Vegetative Propagation

SEXUAL REPRODUCTION	VEGETATIVE PROPAGATION
<ul style="list-style-type: none"> <li>• Slow, uncertain and less economical method.</li> </ul>	<ul style="list-style-type: none"> <li>• Quicker, more certain and less expensive method.</li> </ul>
<ul style="list-style-type: none"> <li>• Seeds are viable and strong to face environmental changes.</li> </ul>	<ul style="list-style-type: none"> <li>• Seeds are less viable and less strong.</li> </ul>
<ul style="list-style-type: none"> <li>• Seedless plants cannot be reproduced by this method.</li> </ul>	<ul style="list-style-type: none"> <li>• Seedless plants can be reproduced by this method.</li> </ul>
<ul style="list-style-type: none"> <li>• Parental characteristics are not retained and get mixed up.</li> </ul>	<ul style="list-style-type: none"> <li>• Genetic characteristics are retained.</li> </ul>
<ul style="list-style-type: none"> <li>• New varieties are possible.</li> </ul>	<ul style="list-style-type: none"> <li>• No new varieties can be produced.</li> </ul>
<ul style="list-style-type: none"> <li>• Overcrowding does not take place due to dispersal of fruits and seeds.</li> </ul>	<ul style="list-style-type: none"> <li>• Overcrowding occurs as there is no dispersal of fruits and seeds.</li> </ul>


### Natural Vegetative Propagation

PROPAGULES	DESCRIPTION	EXAMPLES
<p style="text-align: center;"><b>Rhizome</b></p> 	<ul style="list-style-type: none"> <li>• Underground, horizontal, branching stem.</li> <li>• Always swollen with food reserves.</li> </ul>	<p>Iris, Solomon's seal, couch grass, ginger, turmeric</p>
<p style="text-align: center;"><b>Stem tuber</b></p> 	<ul style="list-style-type: none"> <li>• Swollen tip of underground, lateral stem.</li> <li>• Arises below the ground in the axil of a scale leaf.</li> </ul>	<p>Potato, artichoke</p>
<p style="text-align: center;"><b>Corm</b></p> 	<ul style="list-style-type: none"> <li>• Short, vertical, underground stem, swollen with reserve food.</li> <li>• Grow for only two to three years.</li> </ul>	<p>Crocus, gladiolus</p>
<p style="text-align: center;"><b>Bulb</b></p> 	<ul style="list-style-type: none"> <li>• Underground, lateral branches.</li> <li>• Their ends turn up and produce buds.</li> </ul>	<p>Mint, pear, banana</p>

<p style="text-align: center;"><b>Runners</b></p> 	<ul style="list-style-type: none"> <li>• Lateral branches rise close to the ground.</li> <li>• Grow rapidly along the ground, producing buds and adventitious roots at intervals. These become separate plants.</li> </ul>	<p>Strawberry, creeping grass, Desmodium, hydrocotyle</p>
<p style="text-align: center;"><b>Offsets</b></p> 	<ul style="list-style-type: none"> <li>• Short stout runners terminated by a single bud.</li> </ul>	<p>Houseleek (Pistia), Eichhornia</p>
<p style="text-align: center;"><b>Stolon</b></p> 	<ul style="list-style-type: none"> <li>• When a weak stem falls over and touches the ground, its tip swells. It develops adventitious roots and further growth is continued by a lateral bud.</li> </ul>	<p>Blackberry, fern</p>
<p style="text-align: center;"><b>Root tubers</b></p> 	<ul style="list-style-type: none"> <li>• Swollen fibrous roots, each capable of developing into a new plant.</li> </ul>	<p>Dahlia, sweet potato</p>
<p style="text-align: center;"><b>Leaf buds</b></p> 	<ul style="list-style-type: none"> <li>• Bud detaches and grows into a new plant.</li> </ul>	<p>Dahlia, sweet potato</p>

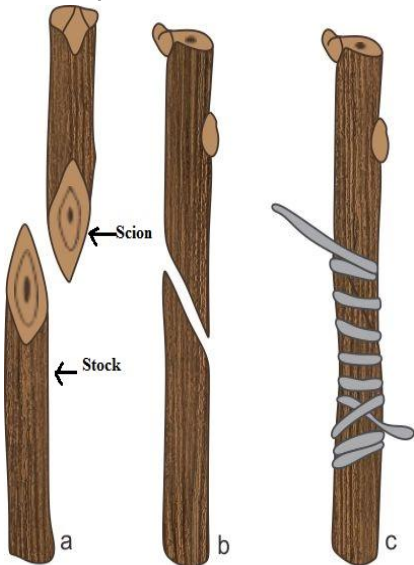
<p><b>Bulbils</b></p>  <p>Labels: Leaf, Stem, Bulbil</p>	<ul style="list-style-type: none"> <li>• Detachable buds</li> </ul>	<p>Yam</p>
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### Artificial Vegetative Propagation

METHOD	DESCRIPTION	EXAMPLES
<b>CUTTING (STEM CUTTING/ROOT CUTTING)</b>		
<p>Cutting is removing a portion of the stem and fixing it into the soil to allow the growth of roots and shoots.</p> 	<ul style="list-style-type: none"> <li>• A cutting of the parent plant from the stem, shoot or branch with some buds on it is taken.</li> <li>• The lower part is buried in moist soil.</li> <li>• After a few days, roots appear on the cutting. New leaves are seen, and it starts to grow into a new plant.</li> <li>• The new plant formed is exactly similar to the parent plant.</li> </ul>	<ul style="list-style-type: none"> <li>• Stem cutting: Rose, <i>Bougainvillea</i>, <i>Chrysanthemum</i>, sugarcane, banana, cactus, <i>Croton</i>, China rose, drumstick, grapes</li> <li>• Root cutting: Lemon, tamarind</li> </ul>

## GRAFTING/SCION GRAFTING


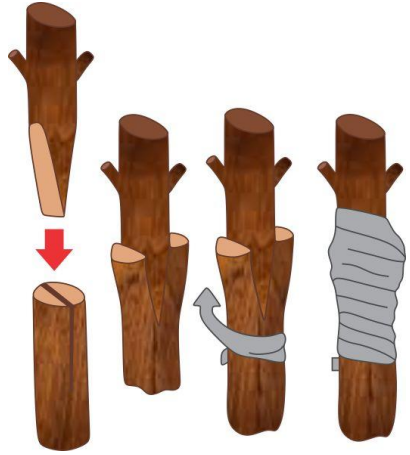
Grafting is joining a part (stem or bud) of a living plant to another, causing it to grow as a part of another plant.

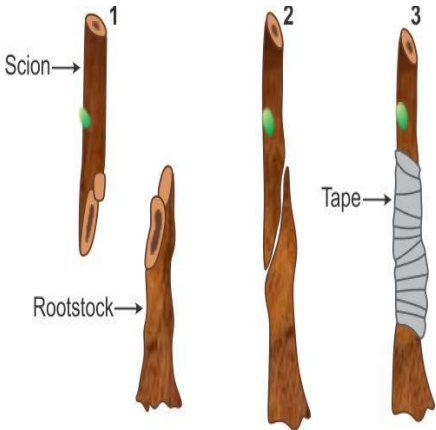
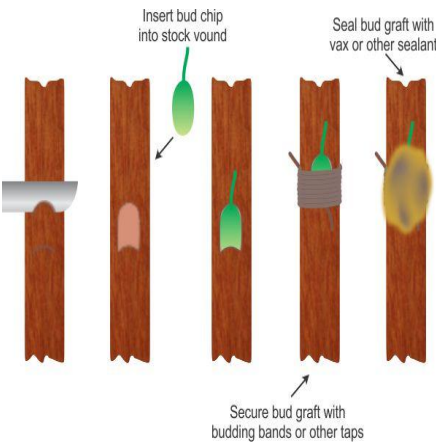


- Two related plants or trees are chosen, one receiving the bud or shoot (stock) and the other as a twig (scion) to be fixed on it.
- A branch or stem of the scion is removed by making a slanting cut.
- The stem of the stock is also cut in a slanting way.
- The scion is placed over the stock and both the cut surfaces are fitted together and then bound together tightly with a piece of cloth.
- As cambium promotes growth, ensure that the cambium layer of the scion is in contact with the cambium layer of the stock.
- The joint is then covered with a polythene sheet to prevent it from getting infected by harmful bacteria, fungus and other disease-causing germs. It also prevents dehydration or loss of water and plant sap from the cut and joined ends of the stock and scion.
- When the cut or the union of the scion and stock heals, the two plants grow together and become a single plant.
- Types of grafting: Approach grafting, cleft grafting, whip grafting, bud grafting.

Sapota, mango, guava, apple, orange, peach, rose



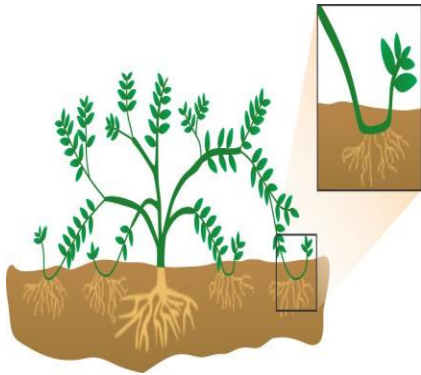
TYPES OF GRAFTING	
<p><b>Approach grafting</b></p> 	<ul style="list-style-type: none"> <li>• The scion and the stock remain rooted.</li> <li>• The stock is first grown in a pot.</li> <li>• A branch of the scion of almost the same thickness as the stock is bent towards the stock.</li> <li>• A small slice is cut off from its stem. A slice of the same size is cut off from the stock.</li> <li>• The two cut surfaces of the stems are brought close to each other so that they are in contact. They are taped firmly together.</li> <li>• When the two stems get united, the top of the stock and the base of the scion are cut off.</li> </ul> <p>Sapota, mango, guava</p>
<p><b>Cleft grafting</b></p> 	<ul style="list-style-type: none"> <li>• A sharp knife is first used to cut across a stem of a plant that has no bends or side branches.</li> <li>• The cut end of the stub is next split like a 'V' to insert a scion.</li> <li>• The same sharp knife is then used to cut a wedge shape in the scion.</li> <li>• While cutting the scion, one must ensure that it has at least two or three good buds on it.</li> <li>• Several slits are made towards the outside of a large stock. A scion is inserted in each slit.</li> <li>• The point of union is held in position firmly by using waxed tape.</li> </ul> <p>Guava, pear</p>

<p><b>Tongue grafting/whip grafting</b></p>  <p>Scion →</p> <p>Rootstock →</p> <p>1</p> <p>2</p> <p>3</p> <p>Tape →</p>	<ul style="list-style-type: none"> <li>• The top of the stock is first cut diagonally and in an upward direction, and the scion is cut diagonally in the downward direction. The cut surfaces should be smooth.</li> <li>• A second cut is made from above downwards to form a tongue. This is made in such a way that the notch or tongue of the scion fits closely with the stock.</li> <li>• It is then wrapped and tied with a twine and finally covered with a waxy tape.</li> </ul>	<p>Tomato, potato</p>
<p><b>Bud grafting</b></p>  <p>Insert bud chip into stock vound</p> <p>Seal bud graft with vax or other sealant</p> <p>Secure bud graft with budding bands or other taps</p>	<ul style="list-style-type: none"> <li>• A T-shaped incision is first made on the bark of the stock. The bark is then loosened on either side of the vertical cut. The buds of the stock should be removed so that they do not compete with the bud that has been grafted.</li> <li>• A single bud from the scion along with little wood is removed and placed in the incision below the bark. It is held in position by applying tape.</li> <li>• Active cells from the bud of the scion and the exposed surface of the stock come together and start producing a new plant.</li> </ul>	<p>Apple, orange, peach, rose</p>



### LAYERING

Layering is a method in which a branch of the plant is covered with some material and supplied with water to produce roots.



- The branch of a plant is pulled towards the ground and a part of it is covered with moist soil to produce roots. Only the tip is left exposed above the ground.
- Within 2–4 months, new roots develop from the part of the branch that is buried in the soil.
- The branch that connects the newly formed plants can then be cut off from the parent plant.

Hibiscus, jasmine, rose, Bougainvillea

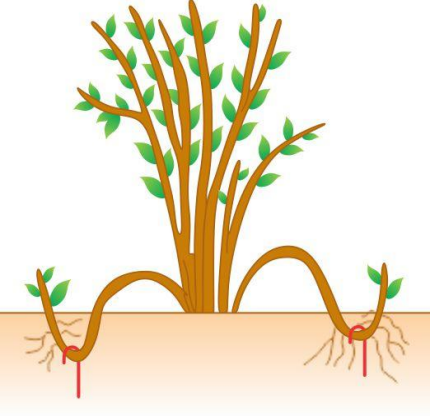
### TYPES OF LAYERING

#### Air/aerial layering



- A healthy branch of the plant is selected, and a girdle is made just below a node.
- The girdle portion is covered with moist moss plants, cotton or polythene sheet to prevent evaporation of moisture.
- An earthen pot with a hole at the bottom is hung from a branch above it to ensure a continuous supply of water.
- This portion is then left undisturbed till adventitious roots appear from above the girdled area.
- When healthy roots appear through the polythene sheet, the layered shoot is separated from the mother plant.

Croton, climbing rose, guava, orange, litchi

<p><b>Ground/mound layering</b></p> 	<ul style="list-style-type: none"> <li>• A branch near the ground is bent downwards so that it touches the soil.</li> <li>• Under a node on the basal side, a cut is made to form a tongue.</li> <li>• With the help of a small piece of wood, the two cut parts are kept apart.</li> <li>• The tongue part is then covered with soil some distance from the tip.</li> <li>• A stone is placed on the layered portion in position or it is covered with soil.</li> <li>• Water is provided whenever required.</li> <li>• After few days, the part that is under the soil develops roots. The layered part can then be separated from the parent plant and grown separately.</li> </ul>	<p><i>Ipomea</i>, rose, jasmine, mango, litchi, grapevine</p>
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**Advantages and Disadvantages of Vegetative Propagation**

<p><b>ADVANTAGES</b></p>	<p><b>DISADVANTAGES</b></p>
<ul style="list-style-type: none"> <li>• Faster and more certain method of propagation.</li> </ul>	<ul style="list-style-type: none"> <li>• Does not produce new varieties.</li> </ul>
<ul style="list-style-type: none"> <li>• New individuals produced have exactly identical qualities as their parents. This preserves the characteristics of food and flower crops.</li> </ul>	<ul style="list-style-type: none"> <li>• Leads to overcrowding around the parent plant.</li> </ul>
<ul style="list-style-type: none"> <li>• Can be used to reproduce plants that do not have viable seeds.</li> </ul>	<ul style="list-style-type: none"> <li>• Very little possibility of dispersal.</li> </ul>
<ul style="list-style-type: none"> <li>• The flowers produced are of a superior quality.</li> </ul>	
<ul style="list-style-type: none"> <li>• Certain desirable characteristics present in the fruit can be maintained.</li> </ul>	