

Objectives

The module will help learners to develop an understanding of Plant Tissue Culture Technology.

Learning Points:

- Totipotency
- Basic requirements for tissue culture
- Explant
- Micropropagation
- Somaclones
- *in- vitro* culture
- Applications of plant Tissue Culture

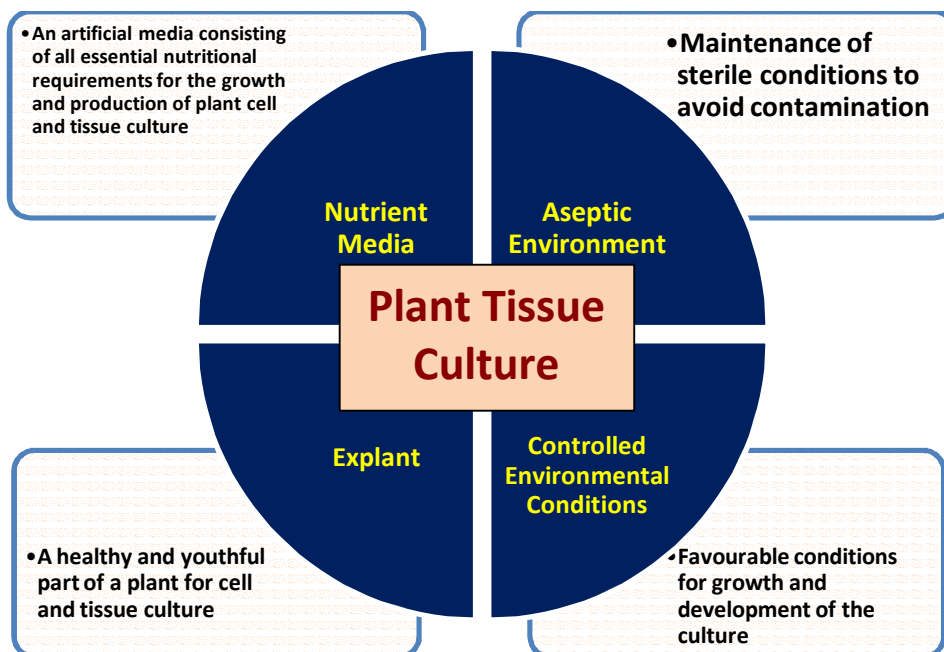
Plant Tissue Culture

Plant Tissue Culture Technique refers to culturing the living plant cells, tissue or organs under controlled environmental conditions on an artificially designed nutrient /culture medium of known composition.

Principle

In this technique the tissue culturists have exploited the inherent capability of a single cell to divide and produce whole plant. This characteristic of a living plant cell is known as **totipotency**. Have you ever studied any of the cells in life cycle of a plant which may serve as an excellent example of totipotency in nature? Do you consider the asexual units for example spores and the product of fertilization, i.e., zygote are totipotent? Your answer will be yes, these are the reproductive units. They divide and grow into an individual.

Basic Requirements of Tissue Culture Technique



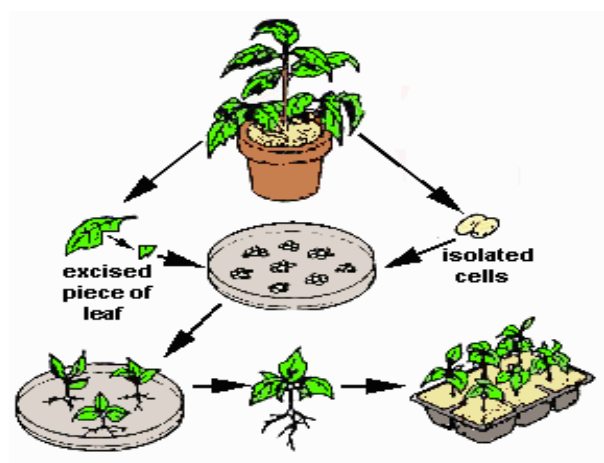
In nature any plant or an individual obtain their nutritional requirements from organic substrate or nutrients in soil. Do you think that it is possible to put these cells/tissue/organs on the artificially defined **nutrient media** instead of soil? By adding all essential nutrients in a definite amount of water, can we grow these plants in laboratory?

You may collect information from the nature about the essential nutrient for the growth of the plant which you wish to grow in the laboratory. Thus nutrient media is one of the most essential prerequisite to begin plant cell and tissue culture in the laboratory.

Usually regeneration of plants through Plant Tissue Culture technique requires media containing following nutrients:

Organic Nutrients	sucrose, vitamins, amino acids and undefined supplements such as coconut water etc
Inorganic nutrients	macro-nutrients (N, P, K, S, Ca and Mg) and micronutrients (Cu, Fe, Zn, Mn, Co and Ni)
Growth regulators	2, 4-D, BAP, TDZ and others
Iron chelates	
Gelling agents	agar, agrose and gelrite

Maintenance of **aseptic environment** is one of the most important requirements to avoid contamination from other microorganisms. Microorganisms grow very fast on the nutrient media for plant tissue culture as their nutritional requirements are



comparatively low than plants. Thus, sterilization of glassware, media and working hood (i.e, laminar air flow) is necessary for aseptic transfer.

A healthy **explant**, i.e, any part of the plant is one of the most important factor for a successful plant tissue culture. The explants should be healthy and consists of youthful dividing cells

The other most important factor associated with the plant tissue culture is the environmental conditions necessary for its growth. In laboratory, the favorable conditions may be controlled and provided to the culture.



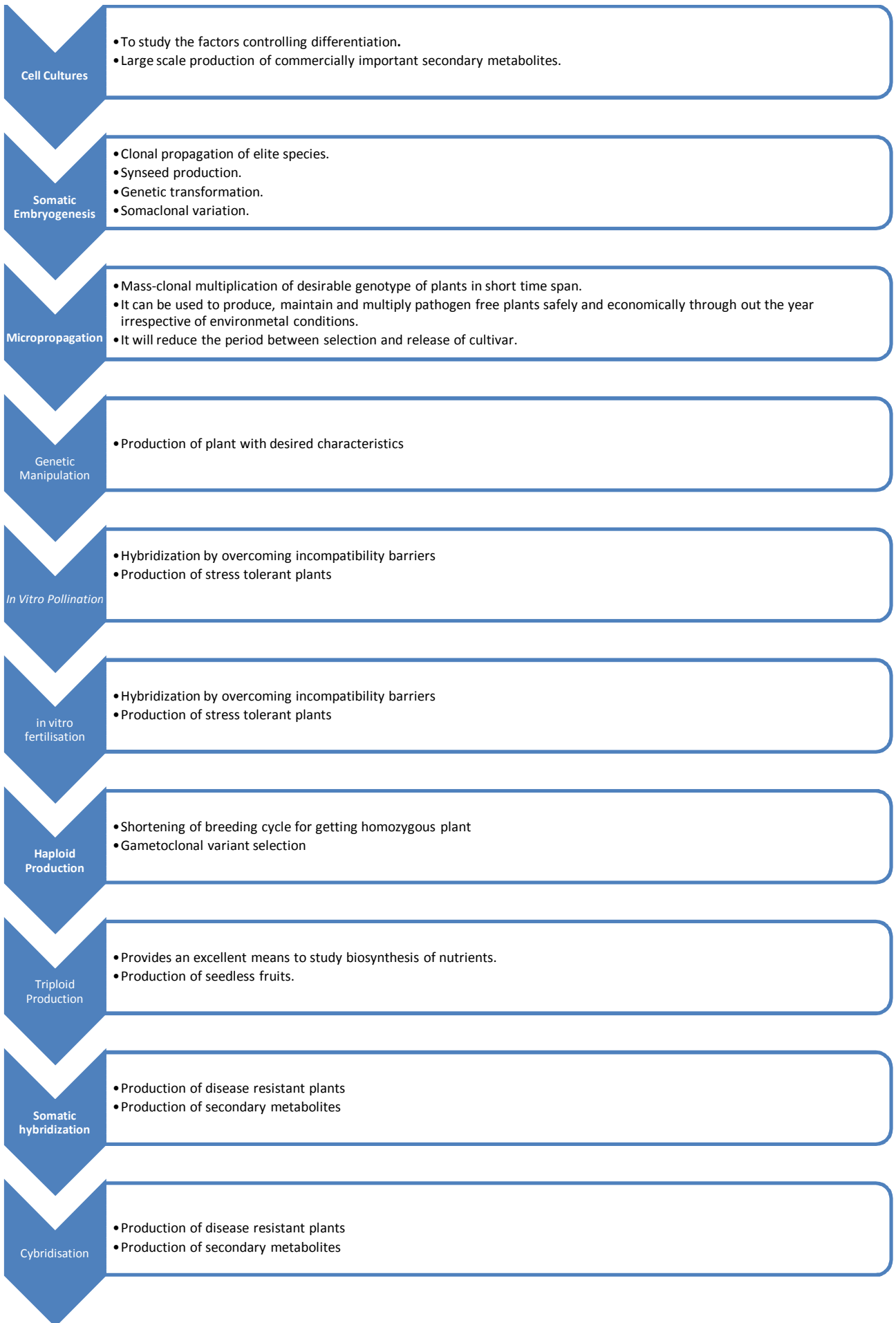
In this technique cells divide and grow to produce and regenerate thousands of plants. This is called **Micropropagation**. All these plants are identical to the plant of which explants was taken and grown are called **somaclones**.

Image Source: https://upload.wikimedia.org/wikipedia/commons/c/c8/Cercis_yunnanensis_-3.JPG

In plant tissue culture, cells or tissue or plants are maintained or grown or multiplied or regenerated inside the culture tube in laboratory by providing it favorable conditions equivalent to its natural biological surroundings. This technique of culturing an isolated living plant cell on the artificial media under laboratory condition is called **in vitro** culture.



Applications of Plant Cell and Tissue Culture:



Assessment Questions

What is totipotency?

What are the basic requirements for tissue culture?

What is an explant?

What is micropropagation?

What is somaclones?

What is in- vitro culture?

Describe various applications of plant Tissue Culture?