

PLANT TISSUE CULTURE

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For M.Sc 4th sem. students

Plant tissue culture is defined as culturing plant seeds, organs, explants, tissues, cells, or protoplasts on a chemically defined synthetic nutrient media under sterile and controlled conditions of light, temperature, and humidity.

Plant tissue culture is a collection of techniques used to maintain or grow plant cells, tissues or organs under sterile conditions on a nutrient culture medium of known composition. It is widely used to produce clones of a plant in a method known as [micropropagation](#). Different techniques in plant tissue culture may offer certain advantages over traditional methods of propagation, including:

- The production of exact copies of plants that produce particularly good flowers, fruits, or have other desirable traits.
- To quickly produce mature plants.
- The production of multiples of plants in the absence of seeds or necessary pollinators to produce seeds.
- The regeneration of whole plants from plant cells that have been genetically modified.
- The production of plants in sterile containers that allows them to be moved with greatly reduced chances of transmitting diseases, pests, and pathogens.
- The production of plants from seeds that otherwise have very low chances of germinating and growing, i.e. [orchids](#) and [Nepenthes](#).
- To clean particular plants of viral and other infections and to quickly multiply these plants as 'cleaned stock' for horticulture and agriculture.

Plant tissue culture relies on the fact that many plant cells have the ability to regenerate a whole plant ([totipotency](#)). Single cells, plant cells without cell walls ([protoplasts](#)), pieces of leaves, stems or roots can often be used to generate a new plant on culture media given the required nutrients and [plant hormones](#).



ContentsApplications

Plant tissue culture is used widely in the plant sciences, forestry, and in horticulture. Applications include:

- The commercial production of plants used as potting, landscape, and florist subjects, which uses meristem and shoot culture to produce large numbers of identical individuals.
- To [conserve](#) rare or endangered plant species.^[7]
- A [plant breeder](#) may use tissue culture to screen cells rather than plants for advantageous characters, e.g. [herbicide](#) resistance/tolerance.
- Large-scale growth of plant cells in liquid culture in [bioreactors](#) for production of valuable compounds, like [plant-derived secondary metabolites](#) and [recombinant proteins](#) used as [biopharmaceuticals](#).^[8]
- To cross distantly related species by [protoplast fusion](#) and regeneration of the novel [hybrid](#).
- To rapidly study the molecular basis for physiological, biochemical, and reproductive mechanisms in plants, for example in vitro selection for stress tolerant plants.^[9]
- To cross-pollinate distantly related species and then tissue culture the resulting embryo which would otherwise normally die (Embryo Rescue).
- For chromosome doubling and induction of [polyploidy](#),^[10] for example doubled haploids, [tetraploids](#), and other forms of [polyploids](#). This is usually achieved by application of [antimitotic agents](#) such as [colchicine](#) or [oryzalin](#).
- As a tissue for transformation, followed by either short-term testing of genetic constructs or regeneration of [transgenic](#) plants.
- Certain techniques such as meristem tip culture can be used to produce clean plant material from virused stock, such as sugarcane^[11], potatoes and many species of soft fruit.
- Production of identical sterile hybrid species can be obtained.
- Large scale production of artificial seeds through somatic embryogenesis^[12]
- Synthetic seeds - A somatic embryo is encapsulated by artificial endosperm and artificial seed coat