

Plant Tissue Culture —

History & Definition —

→ Theoretical Basis for Plant tissue culture was Proposed by G. Haberlandt

→ Gautheret — 1st obtained the True culture from Cambial Tissue of Acer plant.

→ Plant-Tissue culture (Micropropagation) is Generally used for the Aseptic culture of cell/tissue/organ and their component under defined chemical & physical condition *In vitro*.

→ The plant part used in Tissue culture is known as Ex-plant that can be developed into a whole plant. that is ~~applied~~ a central innovative Area of Applied Plant Science, including Agriculture & Plant Biotechnology

→ Plasticity & Totipotency are two important central points of Plant Biotechnology.

→ Plasticity — It is the ability of plant to change their metabolism, Growth, development in order to best suit their environment.

The Important one are regeneration of a lost organ from any tissue & capability to undergo different metabolic pathway.

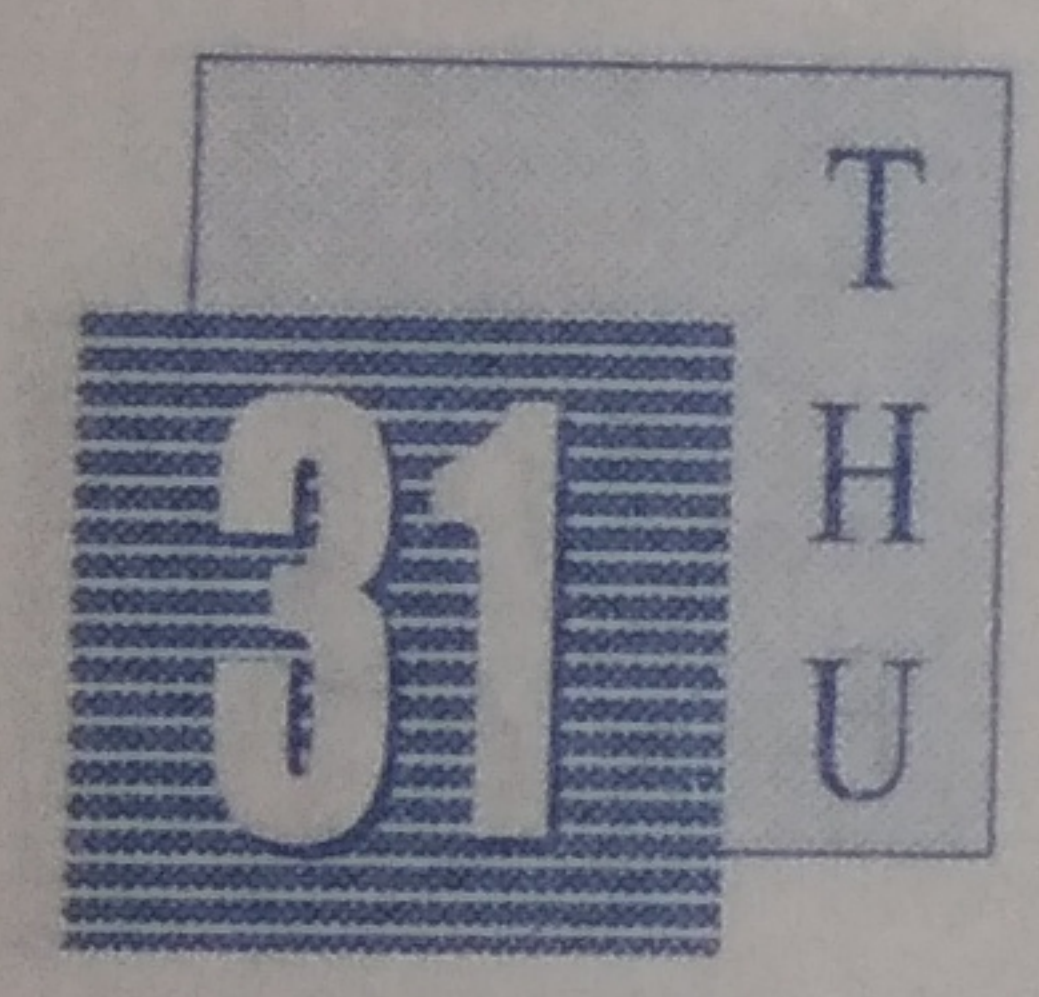
Totipotency - It is the ability of one cell to divide & differentiate into any cell type in a organism. i.e. a whole plant can be regenerated from one cell.

Culture Media -

Composed of 3 Main Basic components -

(1) Source of Fixed Carbon - usually sucrose but Glucose/maltose/sorbitol can also be used under particular circumstances.

(2) Organic Supplements - vitamins (Thiamine/B1 & Myoinositol).
- casein hydrolysate (cheap source of a mix of Amino acid) for Nitrogen. Although plant can synthesize All amino acid.



(3) Essential Elements -

- N P K Ca Mg S etc (Macro elements)
- Mo, B Mn Zn Cu, Fe etc (Micro elements)

- In addition Plant Growth Regulators (Auxin & Cytokinin) are also used.

- Plant cell can be kept either in liquid culture or in Gelled Petri glass culture.

⇒ EDTA (Ethylenediamine tetra acetic Acid) is generally used with Fe-S. that complex with Fe & allow the slow release of Fe. Uncomplexed Fe can ppt out of the medium as Ferric-oxide.

Culture Types—

Cultures are usually initiated from a small sterile piece of plant called Explants.

Generally, the younger, more rapidly growing tissue will give better result. Following are the types—

(1) Callus culture— Undifferentiated growing & dividing mass of cell formed from explant during tissue culture is known as callus.

Manipulation of Auxin/cytokinin ratio can lead to the development of root (more auxin) or shoot (more cytokinin). Callus can also be used to initiate cell suspension to use in many plant transformations.

(2) cell suspension culture—

It can be initiated by placing a friable callus (loosely arranged callus cell) (other type of callus is compact).

Single or small clump of cell is placed into the medium where they grow & divide eventually a cell suspension. Cell suspension culture can also be subcultured.

(3) Protoplast culture— are the plant cells with their cell wall removed, mechanically, but generally enzymatically using cellulase + pectinase.

Protoplasts are fragile so treated with care. Liquid medium is NOT agitated & a high osmotic potential is maintained. It also liquid should be shallow enough to allow aeration.

(4) Root Tip / Shoot Tip / & Meristem Culture

Root Tips of either Primary or lateral roots & Shoot Tips containing Apical meristems are used as explant.

(5) Embryo Culture - Immature or mature Embryo can be used as explant.

(6) Microspore Culture - It is initiated from

Haploid Tissue culture using Pollen grain (containing male gametophyte) as explant.

There are 2 approach - either the Anthers are cultured on solid medium or in liquid medium.

In some cases, female gametophyte (ovule) is used instead with better efficiency.

Plants obtained from Haploid cultures is not invariably haploid. Treatment with colchicine leads to chromosome doubling. Such plants are referred to as diploids.