

# Plant tissue culture



**Pharmacognosy  
lecture stage 2**

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# Plant Tissue Culture Applications

**Plant tissue culture** is a technique of growing plant cells, tissues, organs, seeds or other plant parts in a sterile environment on a nutrient medium.

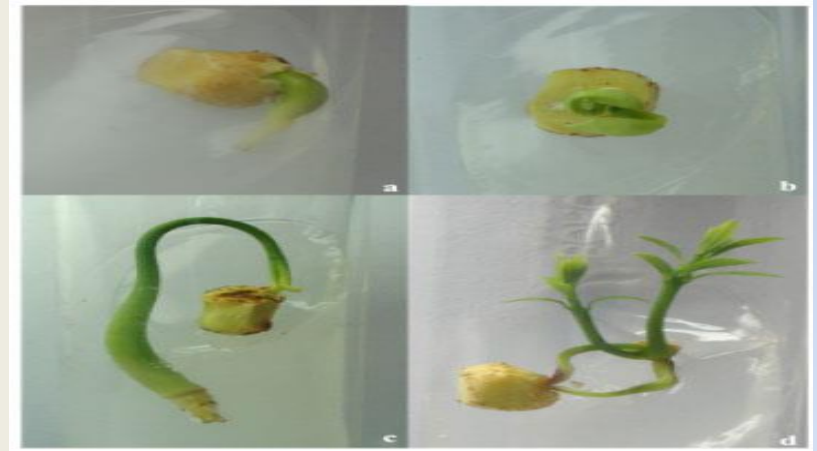


Adult plant cells are **totipotent**, meaning they have the ability to give rise to a fully differentiated plant. Because of this, it is possible to collect cells from a mature plant and use those cells to produce clones of that plant.

# Types of Tissue Culture

## Seed Culture

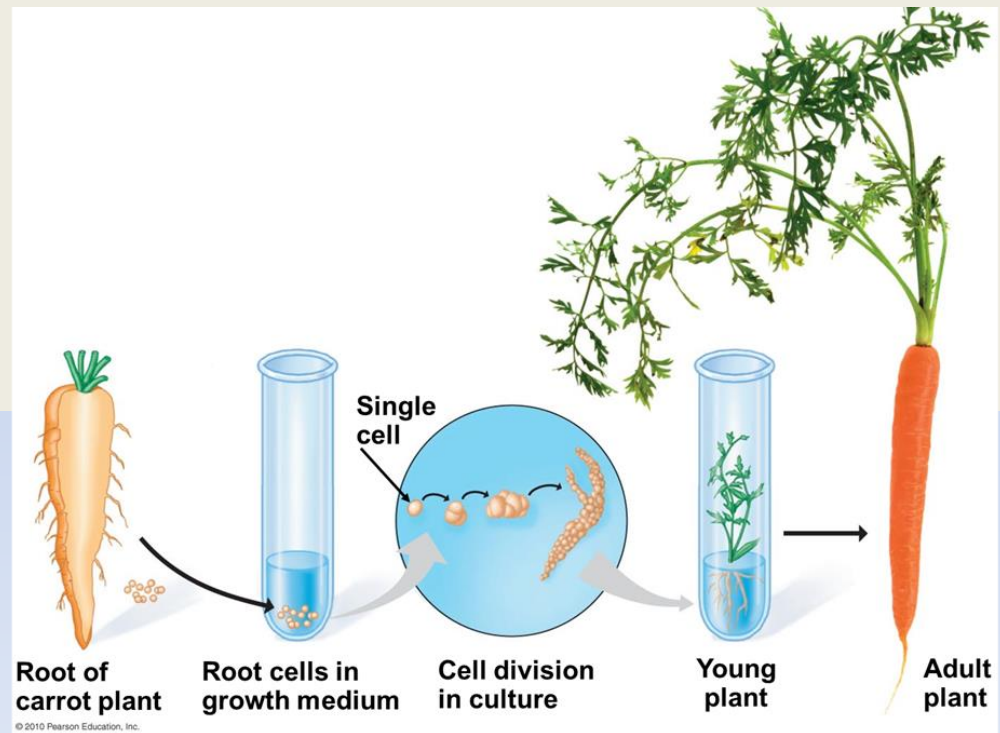
Seed culture is the type of tissue culture that is primarily used for increasing efficiency of germination of seeds that are difficult to germinate in vivo



# Types of Tissue Culture

## Embryo Culture

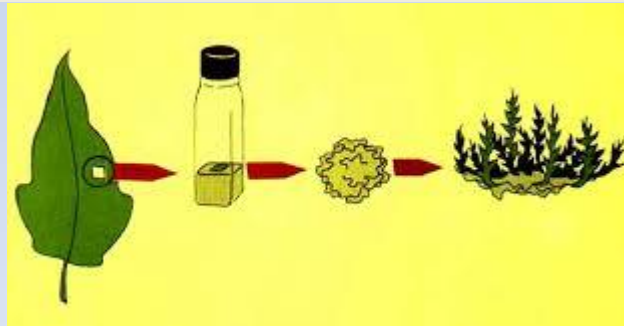
Embryo culture is the type of tissue culture that involves the isolation of an embryo from a given organism for in vitro growth



# Types of Tissue Culture

## Callus Culture

Callus - This is the term used to refer to unspecialized, unorganized and a dividing mass of cells. A callus is produced when explants (cells) are cultured in an appropriate medium - A good example of this is the tumor tissue that grows out of the wounds of differentiated tissues/organs.



# Why go to use the tissue culture?

1-The production of clones of plants that produce particularly good flowers, fruits, or have other desirable traits.

2-To quickly produce mature plants.

3-The production of multiples of plants in the absence of seeds.

4-The regeneration of whole plants from plant cells that have been genetically modified.



**why?**

# 5- Production of plants in sterile containers reduces disease transmission



6-Allows production of plants from seeds that otherwise have very low chance of germinating and growing, i.e.: **orchids** and *Nepenthes*.





# THE CULTURE ENVIROMENT

The tissue culture required nutrient medium that contains sucrose, inorganic salts, vitamins and growth regulators such as auxins and cytokinins ).

The growth medium has to supply all the essential mineral ions required for **growth and development.**

- In many cases (as then biosynthetic capability of cells culture in vitro may not replicate that of the parent plant) it must also supply additional **organic supplement** such as **amino acids and vitamins**.
- Many plant cell cultures, **as they are not photosynthetic**, also require the addition of a fixed **carbon source** in the form of a sugar (most often **sucrose**).

- One other vital component that also must be supplied is water, the principal biological solvent.

- Physical factors such as temperature, pH, gaseous environment, light and osmotic pressure, also have to be maintained within acceptable limit.



# PLANT CELL CULTURE MEDIA

Culture media used for the in vitro cultivation of plant cell are composed of:

1. Essential elements or mineral ions supplies as a complex mixture of salts.
2. An organic supplement supplying vitamins and/or amino acids.
3. A source of fixed carbon, usually supplied as the sugar sucrose.



***Essential elements are further divided into:***

- 1. Macroelements (or macronutrients).***
- 2. Microelements (or micronutrients).***
- 3. An iron source.***

# **MACROELEMENTS**

As is implied by the name, the stock solution supplies those elements required in *large amount for plant growth and development.*

**Nitrogen, Phosphorus, potassium, magnesium, and sulphur (and carbon which is added separately) are usually regarded as macrolelement.**

**These elements usually comprise at least 0.1% of the dry weight of plants.**



- **Nitrogen** is most commonly supplied as a mixture of nitrate ions (from the  $\text{KNO}_3$ ) and ammonium ions (from  $\text{NH}_4\text{NO}_3$ ).

Theoretically, there is an advantage in supplying nitrogen in the form of ammonium ions, as nitrogen must be in the reduced form to be incorporated into macroelements.

- **However at high concentration, ammonium ions can be toxic to plant cell and uptake of ammonium ions from the medium cause acidification of the medium.**
- **In order to use ammonium ions as a sole source for nitrogen, the medium need to be buffered.**

.High concentration of ammonium ions can also cause culture problems by increasing the frequency of vitrification (the culture appear pale and glassy and usually unsuitable for further culture).



- **Phosphorus** is usually supplied as the phosphate ion of ammonium, sodium or potassium salts.
- High concentration of phosphate can lead to precipitation of medium elements as **insoluble phosphate salts**.