



# RAMA UNIVERSITY

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FACULTY OF ENGINEERING &  
TECHNOLOGY

**Course: B. Tech Biotechnology**  
**Sub Code: BBT-515**

**Semester: 5th**  
**Sub Name: Plant Biotechnology**

# LECTURE 1

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## INTRODUCTION TO PLANT BIOTECHNOLOGY

- The application of **scientific method to manipulate living cells or organisms** for practical uses.
- It is a biological phenomenon for copying and manufacturing various kinds of useful substances.
- It is a **controlled use of biological agents** such as micro-organisms or cellular components for beneficial use.

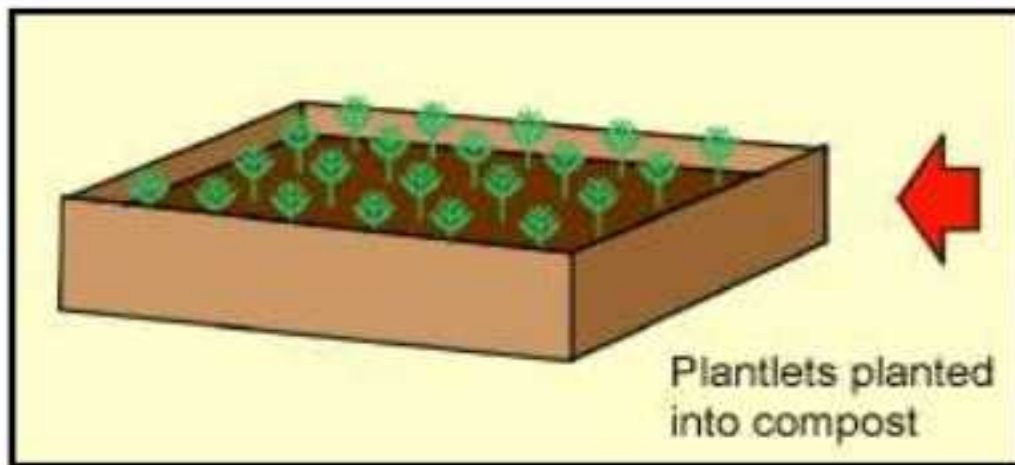
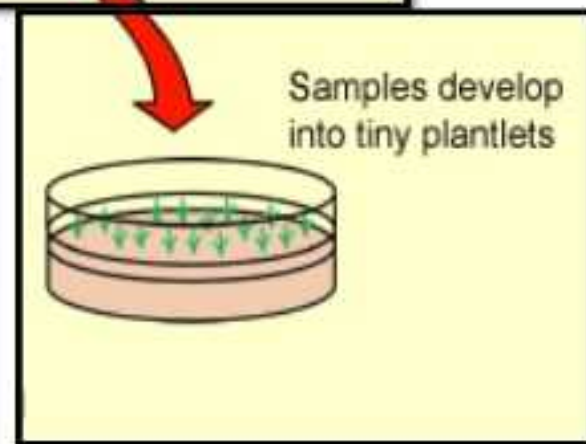
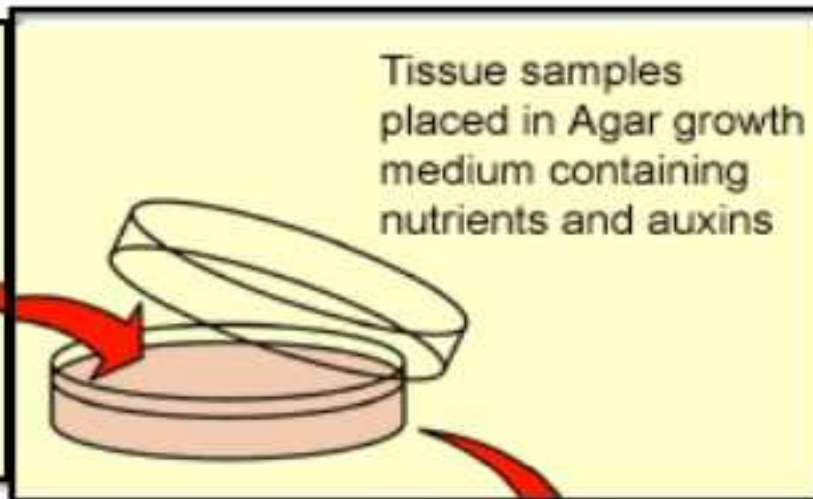
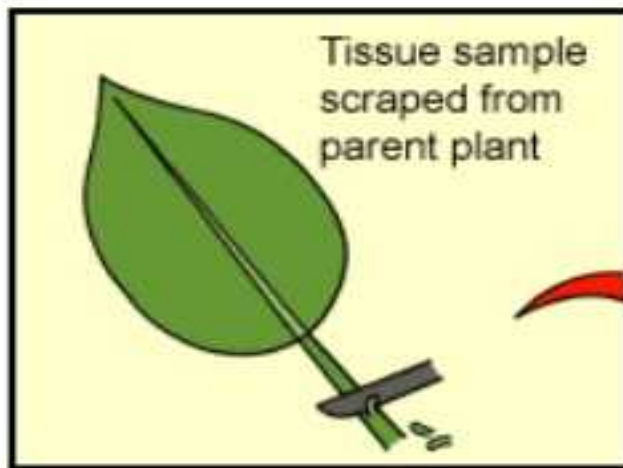


**The Product** = a plant **genetically modified** than the mother plant in some aspects

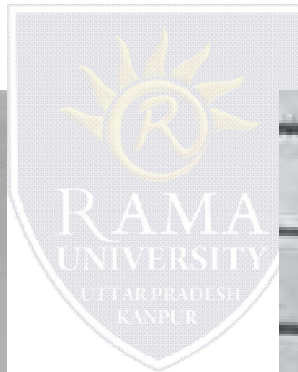
## PLANT TISSUE CULTURE

- The term “**Plant tissue culture**” broadly refers to the **in vitro cultivation of plant parts under aseptic conditions.**
- 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.
- **Gottlieb Haberlandt** was the first person to make attempts for plant tissue culture, i.e., he developed the concept of in-vitro culture of plant cells and is aptly regarded as **the father of tissue culture.**
- In India, the work on tissue culture was initiated during 1950s at University of Delhi. This initiation is credited to Shri Panchanan Maheshwari who was working there in the Department of Botany.

**The Product** = a plant **exactly similar** to the mother plant in some aspects



**Shri S.C. Maheshwari** and **Sipra Guha** made a remarkable contribution in the development of plant tissue culture in India. In **1966, the discovery of haploid production** by them was a land-mark in the development of in-vitro culturing of plants.



# HISTORY OF PLANT TISSUE CULTURE

## Condensed Chronology of Important Development in the Plant Tissue Culture:

Year	Worker	Contribution
1902	C.Haberlant	First attempt to culture isolated plant cells in vitro on artificial medium
1922	WJ Robbins and W. Kotte	Culture of isolated roots ( for short periods) ( organ culture)
1934	P R White	Demonstration of indefinite culture of tomato roots ( long period)
1939	R J Gautheret and P Nobecourt	First long term plant tissue culture of callus, involving explants of cambial tissues isolated from carrot.
1939	P R White	Callus culture of tobacco tumor tissues from intersepcific hybrid of Nicotina glaucum X N.longsdorffi
1941	J Van Overbeek	Discovery of nutritional value of liquid endosperm of coconut for culture of isolated carrot embryo.
1942	P R White and A C	Experiments on crown-gall and tumor formation in



Father of plant tissue culture is considered to be the German Botanist HABERLANDT who conceived the concept of cell culture in 1902.

	Braun	plants, growth of bacteria free crown-gall tissues.
1948	A Caplan and F C Stewart	Use of coconut milk plus 2, 4-D for proliferation of cultured carrot and potato tissues
1950	G Morel	Culture of monocot tissues using coconut milk.
1953	W H Muir	Inoculation of callus pieces in liquid medium can give a suspension of single cells amenable to subculture. Development of technique for culture of single isolated cells.
1953	W Tulecke	Haploid culture from pollen of gymnosperm ( Ginkgo)
1955	C O Miller, F Skeog and others	Discovery of cytokinins. E.g. Kinetin, or potent cell division factor.
1955	E ball	Culture of gymnosperm tissues ( Sequoia)
1957	F Skoog and C O Miller	Hypotheses that shoot and root initiation in cultured callus is regulated by the proportion of auxins and cytokinins in the culture medium.
1960	E C Cocking	Enzymatic isolation and culture of protoplast.
1960	G Morel	Development of shoot apex culture technique.
1964	G Morel	Use of modified shoot apex technique for orchid propagation.
1966	S G Guha and S C Maheshwari	Cultured anthers and pollen and produce haploid embryos.
1974	J P Nitsch	Culture of microspores of Datura and Nicotina, to double the chromosome number and to harvest seed from homozygous diploid plants just within five months.
1978	G Melchers	Production of somatic hybrids from attached to plasmid vectors into naked plant protoplast.
1983	K A Barton , W J Brill and J H Dodds Bengochea	Insertion of foreign genes attached to plasmid vectors into naked plant protoplast.
1983	M D Chilton	Production of transformed tobacco plants following single cell transformation or gene insertion.



## SIGNIFICANT CONTRIBUTIONS OF SELECTED SCIENTIST

### G. Haberlandt

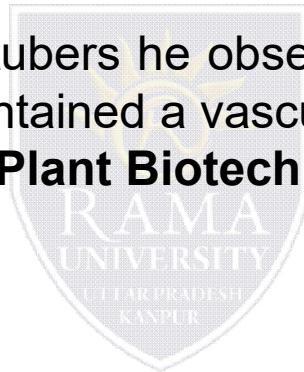
- ❖ Gave the idea of culturing isolated plant cells in the nutrient solution.
- ❖ He isolated mesophyll cells with Knop's nutrient solution.
- ❖ Haberlandt described the cultivation of mesophyll cells of *Lamium in purpureum* and *Eichhornia crassipes*.
- ❖ Using pieces of mature potato tubers he observed that cell division almost without exception when the explants contained a vascular strand.
- ❖ He is also **known as Father of Plant Biotechnology** .

### P. Nobecourt

- ❖ He is French plant pathologist.
- ❖ He gave the possibility of cultivating plant tissues for unlimited period.

### P.R. Gautheret

- ❖ He used piece of cambium cut from tree, attempts were made on liquid medium.
- ❖ Which failed to grow but on solid medium the very healthy callus was grown .



## Philip R. White

- ❖ He reported for first time success full continues cultures of tomato root tips and obtained indefinite growth of roots.
- ❖ Knop's salt solution later replaced by vitamins pyrodoxine, thiamine and nicotinic acid.

## F.C. Steward

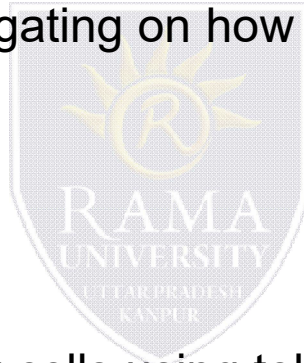
- ❖ He is Known as of the pioneers of plant tissue culture & contributed by giving the requirement of plant tissue culture & developing techniques for the different application.
- ❖ Used coconut water for the first time and obtained good result from it.
- ❖ Gave the somatic embryogenesis concept form cell suspension of carrot cells.

## J. Reinert

- ❖ Gave the concept of totipotency of cells.
  - ❖ Conducted experiment on parenchymat our cells of carrot root in complex medium.
  - ❖ Worked on embryogenesis on carrot cells.
-

## Folke Skoog

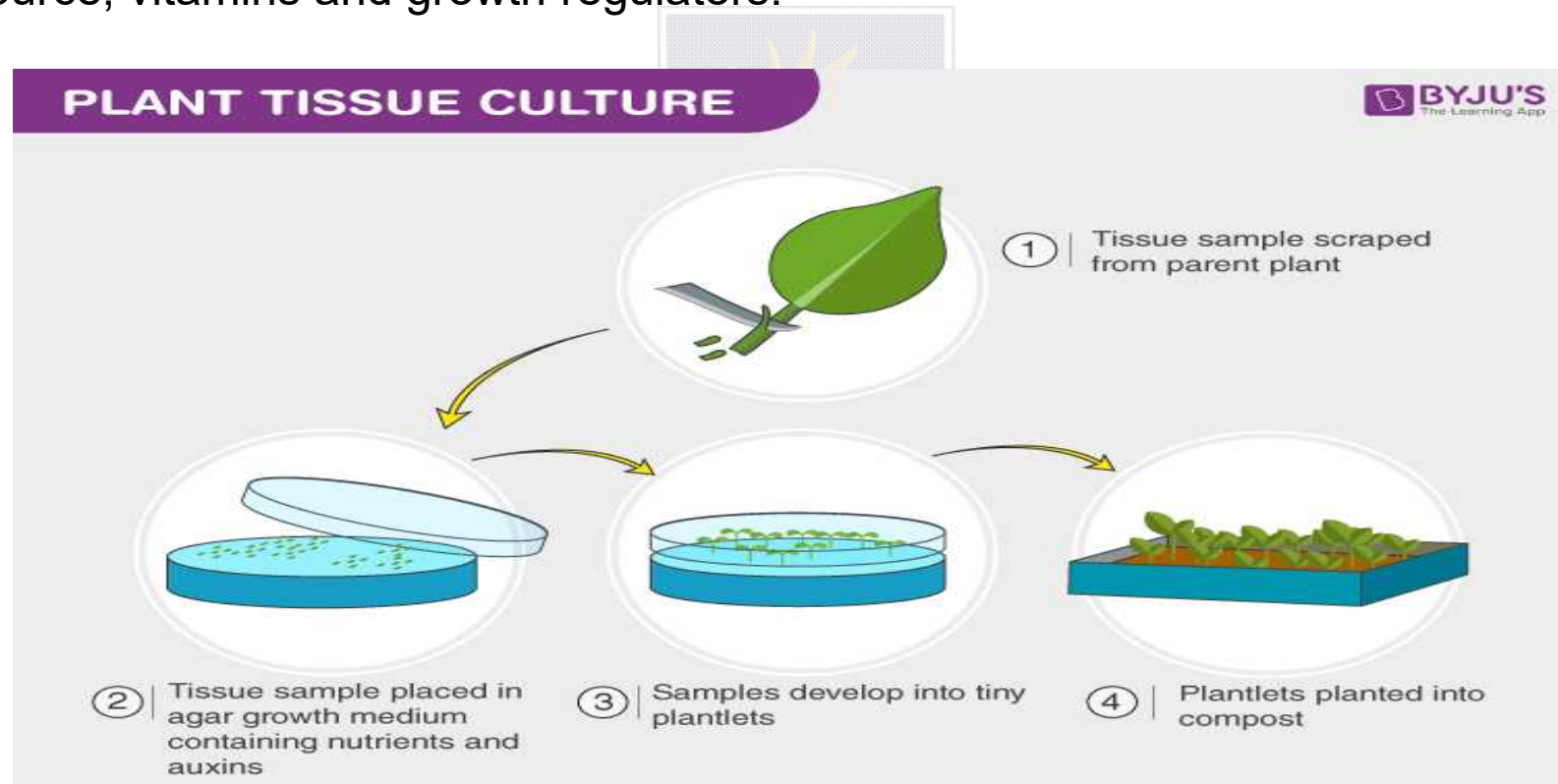
- ❖ Done pioneering work with auxin, a plant growth hormones.
- ❖ Also work with cytokinin, he also showed that number of cytokinins occur naturally.
- ❖ He was also pioneer in investigating on how to control formation of roots, stem and leaves.



## Toshio Murashige

- ❖ He worked on nutrition of plant cells using tobacco pith cells.
  - ❖ He formulated the white medium which was known as Murashige & Skoog medium.
  - ❖ Developed the micro-propagation technique.
  - ❖ Worked on somatic embryo formation using carrot and citrus plants.
-

Such parts as meristems, apices, axillary buds. Young inflorescence, leaves, stems, and roots have been cultured. A controlled aseptic environment and suitable nutrient medium are the two chief requirements for successful tissue culture. These essential nutrients include inorganic salts, a carbon and energy source, vitamins and growth regulators.

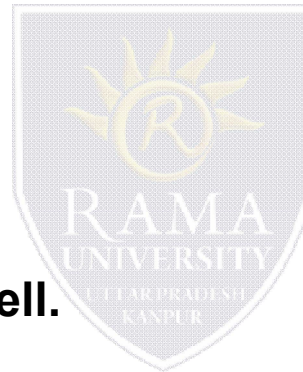


# QUIZ 1

1. Who is known as the father of tissue culture?

- (a) Bonner
- (b) Laibach
- (c) Haberlandt
- (d) Gautheret

**Sol: (c) Haberlandt.**



2. A plant cell is a prokaryotic cell.

- a) True
- b) False

View Answer

Answer: b

3. Shri S.C. Maheshwari and Sipra Guha are famous for the discovery of

.....

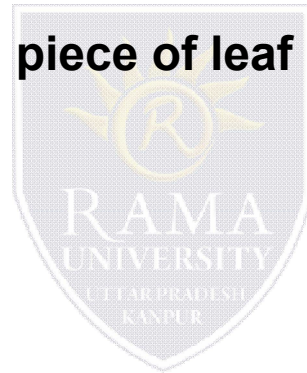
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4. Plant tissue culture technique is a redefined method of \_\_\_\_\_

- a) Hybridization
- b) Vegetative Propagation**
- c) Asexual Reproduction
- d) Selection

5. A(n) \_\_\_\_\_ is an excised piece of leaf or stem tissue used in micropropagation.

- a) micro shoot
- b) medium
- c) explant**
- d) Scion



6. Who gave the concept of totipotency of cells?

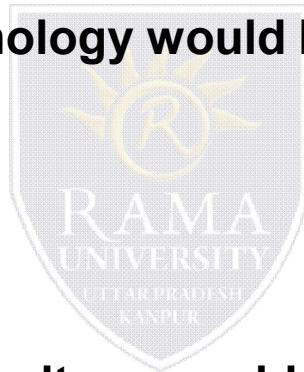
- a) F.C Steward
- b) Philip R. White
- c) Toshio Murashige
- d) J. Reinert

**7. Toshio Murashige developed ..... technique.**

**8. The two chief requirements for successful tissue culture are.....**

**9. The product of plant biotechnology would be**

- a) Genetically modified
- b) Exactly similar
- c) Both
- d) None



**10. The product of plant tissue culture would be**

- a) Genetically modified
  - b) Exactly similar
  - c) Both
  - d) None
-

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THANK  
YOU!

