

## **Introduction of Biotechnolohy**

Biotechnology is technology based on biology - biotechnology harnesses cellular and biomolecular processes to develop technologies and products that help improve our lives and the health of our planet. We have used the biological processes of microorganisms for more than 6,000 years to make useful food products, such as bread and cheese, and to preserve dairy products.

Biotechnology helps the world by:

- ✓ Biotechnology helps to meet our basic needs (Food, clothing, shelter, health and safety)
- ✓ Also used in maintaining a good environment that promotes our well being
- ✓ Using scientific processes to get new organisms or new products from organisms.

## **Present definition of biotechnology**

Any technological application that uses biological system, living organisms or derivatives theory, to make or modify or processes for specific use.

## **INTRODUCTION TO PLANT BIOTECHNOLOHY**

The word "biotechnology" was first used in 1917 to describe processes using living organisms to make a product or run a process, such as industrial fermentations. In fact, biotechnology began when humans started to plant their

own crops, domesticate animals, ferment juice into wine, make cheese, and leaven bread.

## **Plant biotechnology**

"Plant biotechnology describes a precise, process in which scientific techniques are used to develop useful beneficial plants.

### **Definitions:**

- ✓ Any technique that uses living organisms or substances from those organisms to make or modify a product, to improve plants or animals.... or to develop microorganisms for specific uses.
- ✓ Biotechnology is the manipulation of living organisms and organic material to serve human needs.

Examples:

- ❖ Yeast in bread making and making and alcohol production  
Use of beneficial bacteria (penicillin) to kill harmful organisms
- ❖ Cloning of plants and animals
- ❖ GM plants
- ❖ Artificial insemination

### **Organismic Biotech**

- ✓ Working with complete, intact organisms or their cells
- ✓ Organisms are not genetically changed with artificial means.
- ✓ Help the organism live better or be more productive
- ✓ Goal – improve organisms and the conditions in which they grow
- ✓ Study and use natural genetic variation
- ✓ Cloning is an example of organismic biotech

**Cloning:** Process of producing a new generation from cells or tissue of existing organisms. In 1997 cloned sheep-“Dolly” in Edinburgh Scotland.

### **Molecular Biotech**

Biotech improves crop insect resistance, enhances crop herbicide tolerance and facilitates the use of more environmentally sustainable farming practices. Biotech is helping to feed the world by:

- Generating higher crop yields with fewer inputs.
- Lowering volumes of agricultural chemicals required by crops-limiting the run-off of these products into the environment.
- Using biotech crops that need fewer applications of pesticides and that allow farmers to reduce tilling farmland.
- Developing crops with enhanced nutrition profiles that solve vitamin and nutrient deficiencies.
- Producing foods free of allergens and toxins such as mycotoxin.
- Improving food and crop oil content to help improve cardiovascular health.

### **Biotech Example:**

- ✓ Medicine
- ✓ Agriculture
- ✓ Environment

- ✓ Food and beverage processing

### **Genetic engineering:**

- ✓ Changing the genetic information in a cell.
- ✓ Specific trait of one organism may be isolated, cut, and moved into cell of another organism.
- ✓ Transgenic is a gene or genetic material that has been transferred naturally, or by any of a number of genetic engineering techniques from one organism to another. The introduction of a transgene has the potential to change the phenotype of an organism.
- ✓ Paul Berg (1972) Stanford University scientist who first develop, recombinant DNA technology, a method for insertion of gene, material from one organism into another.

### **History of Plant bioteehnology**

#### **1. Early plant breeding**

- ❖ Humans domesticate crops.
- ❖ Breed plants to further improve desirable characteristics.

#### **2 . Classical plant breeding**

- ❖ Founding of the science of genetics.
- ❖ Cross-breeding to strengthen traits.

#### **3.Modern Plant breeding**

A basic type or modern plant breeding:

- Mutation breeding
- Plant tissue culture breeding

- Green revolution

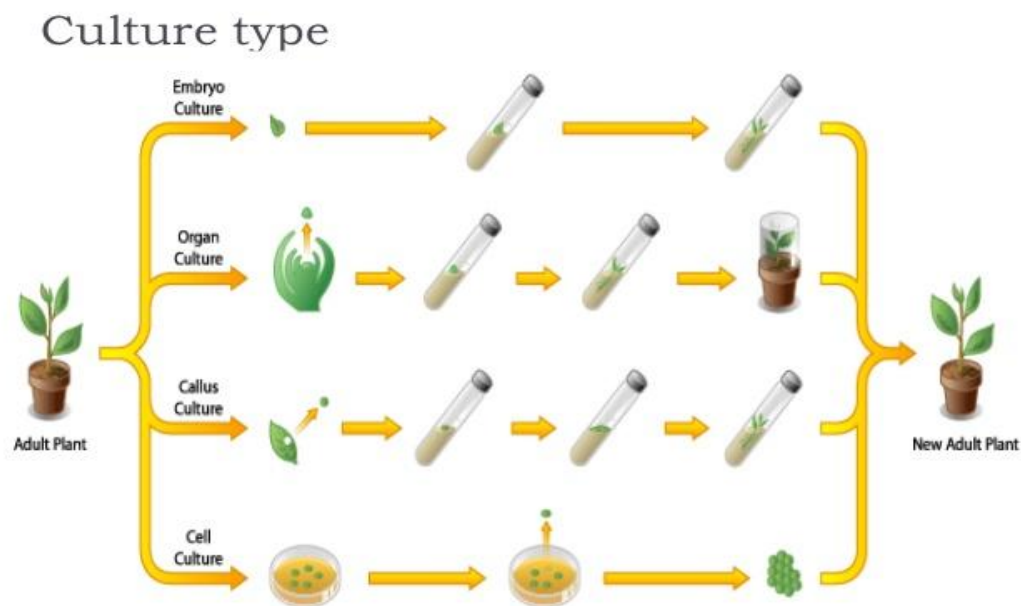
### **Mutation breeding:**

Mutation breeding, sometimes referred to as "variation breeding", is the process of exposing seeds to chemicals or radiation in order to generate mutants with desirable traits to be bred with other cultivars. Plants created using mutagenesis are sometimes called mutagenic plants or mutagenic seeds.

- The mutations are at random over the genome.
- Usually mutation results in a loss of function of genes.

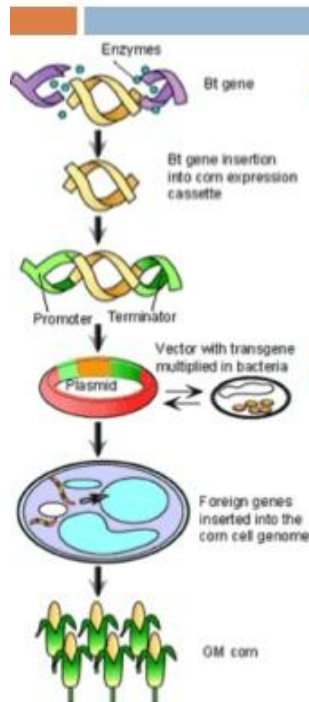
## **Two major areas of plant biotechnology**

### a. Plant Tissue Culture (Plant cloning)



### b. Recombinant DNA technology (gene cloning)

## Cloning Application: Bt Plants

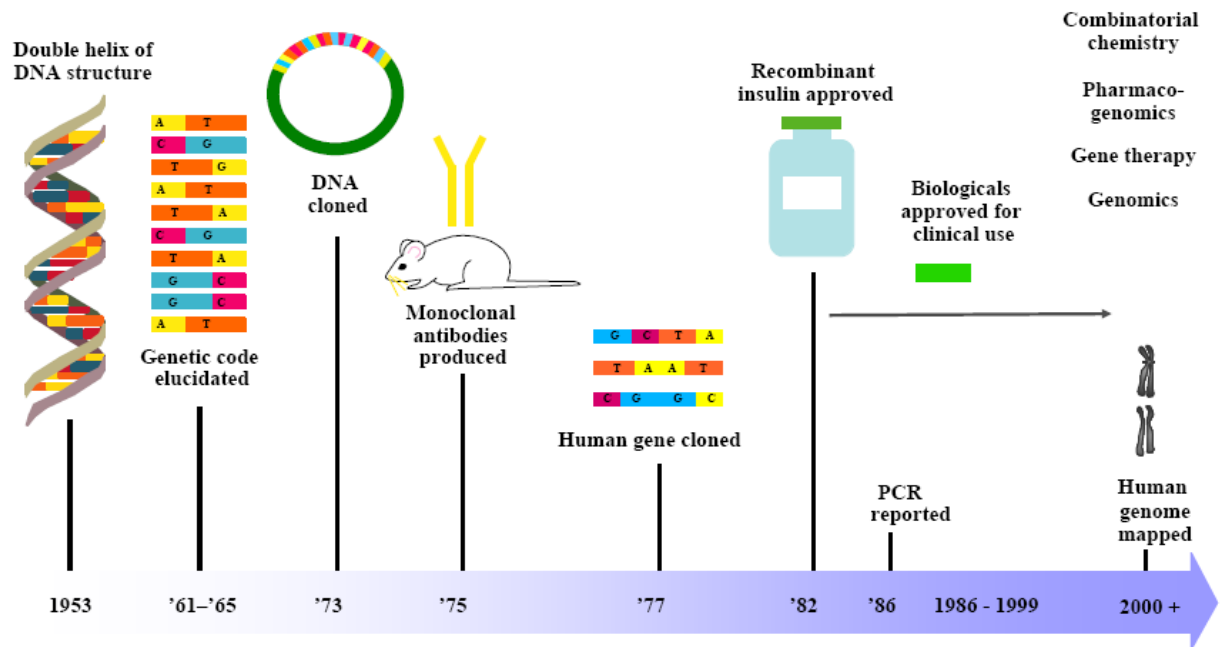


- **Bacillus Thuringiensis** is a bacterium used as a biological pesticide
- Bt gene is cloned into plants so that they will be resistant to pests



## History of biotechnology

### Evolution of Biotechnology



1830: Proteins are discovered.

1833: First enzyme is discovered and isolated

1865: Gregor Mendel discovers the laws of inheritance by studying flowers in his garden. The science of genetics begins.

1915: Phages — viruses that only infect bacteria — are discovered

1927: Herman Muller discovers that radiation causes defects in chromosomes.

1944: DNA is proven to carry genetic information by Oswald Avery, Colin MacLeod and Maclyn McCarty.

1953: James Watson and Francis Crick describe the double helical structure of DNA. They shared the 1962 Nobel Prize in Medicine or Physiology with Maurice Wilkins.

1955: The amino acid sequence of insulin is discovered by Frederick Sanger.

1958: DNA is made in a test tube for the first time. Sickle cell disease is shown to occur due to a change in one amino acid

1971: The first complete synthesis of a gene occurs. Discovery of *restriction enzymes* that cut and splice genetic material very specifically occurs. This opens the way for gene cloning.

1973: Stanley Cohen and Herbert Boyer perfect genetic engineering techniques to cut and paste DNA using restriction enzymes.

1981: The first transgenic animals are produced by transferring genes from other animals into mice.

1983: The polymerase chain reaction (PCR) technique, which makes unlimited copies of genes and gene fragments, is conceived. Kary Mullis, who was born in Lenoir, N.C., wins the 1993 Nobel Prize in Chemistry for the discovery.

1986: First recombinant vaccine is approved for human use: hepatitis B. First anti-cancer drug is produced through biotech: interferon.

1987: First approval for field tests of a genetically modified food plant: virus-resistant tomatoes.

1994: Genetically modified tomatoes are sold in the U.S. for the first time.