



## Introduction to Biotechnology:

Biotechnology: Can simply be define as the application of biological system, living organisms

or their derivatives in making or modifying products or processes for specific use

Biotechnology is a field that deals with studying, manipulating and creating nucleic acids and their by-product proteins. This field emerged from our understanding of how DNA and RNA molecules actually work and how they are used by the biological systems that exist in nature.

- \* Biotechnology is not a single technology; it is a group of technologies.
- \* Biotechnology is based on biology, which is the study of life. The basic unit of life is the cell.
- \* Biologists study the structure and functions of cells—what cells do and how they do it.
- \* Biotechnologists use this information to develop products.

## Biotechnology makes use of findings from various research areas, such a:

Molecular Biology, Separation Technology, Genetic, Cell Biology, Bioinformatics, Biochemistry and Microbiology

## Development of Biotechnology:

Over the last 100 hundred years or so, biotechnology emerged with the following discoveries and advancements:

**1919.** Hungarian scientist Karl Ereky coins the term *biotechnology*.

**1928.** Alexander Fleming discovers penicillin, the first true antibiotic.



- 1943.** Oswald Avery proves DNA carries genetic information.
- 1953.** James Watson and Francis Crick discover the double helix structure of DNA.
- 1960s.** Insulin is synthesized to fight diabetes, and vaccines for measles, mumps and rubella are developed.
- 1969.** The first synthesis of an enzyme in vitro, or outside the body, is conducted.
- 1973.** Herbert Boyer and Stanley Cohen develop genetic engineering with the first insertion of DNA from one bacteria into another.
- 1980s.** The first biotech drugs to treat cancer are developed.
- 1982.** A biotech-developed form of insulin becomes the first genetically engineered product approved by the U.S. Food and Drug Administration (**FDA**).
- 1983.** The first genetically modified plant is introduced.
- 1993.** GMOs are introduced into agriculture with the FDA approval of growth hormones that produce more milk in cows.
- 1997.** The first mammal is cloned.
- 1998.** The first draft of the **Human Genome Project** is created, giving scientists access to over 30,000 human genes and facilitating research on treatment of diseases such as cancer and Alzheimer's.
- 2010.** The first synthetic cell is created.
- 2013.** The first bionic eye is created.
- 2020.** mRNA vaccine and monoclonal antibody technology is used to treat the SARS-CoV-2 virus.

## Historical development of biotechnology (Figure 1):

### 1) Ancient Biotechnology (before 1885)

- Discovering of microorganisms
- Traditional microbial industries (bread, cheese, beer and wine)

### 2) Classical Biotechnology (1885-1975)

The fermentation theory of Pasteur

- Production of single cell protein (SCP), antibiotics, enzymes, vitamins, amino acids, gibberellins, nucleotides, steroids, chemicals like acetone, butanol, ethanol and organic acids.
- Tissue cultures techniques

### 3) Modern Biotechnology (1975-until now)

- Enhancement of microorganisms' productivity by genetic engineering techniques
- Production of therapeutic proteins (insulin, interferon, etc)
- Production of new sources of energy (Biogas and biodiesel)
- Production of vaccines by plants
- Production of genetically modified foods (GMF)
- Production of artificial chromosomes.

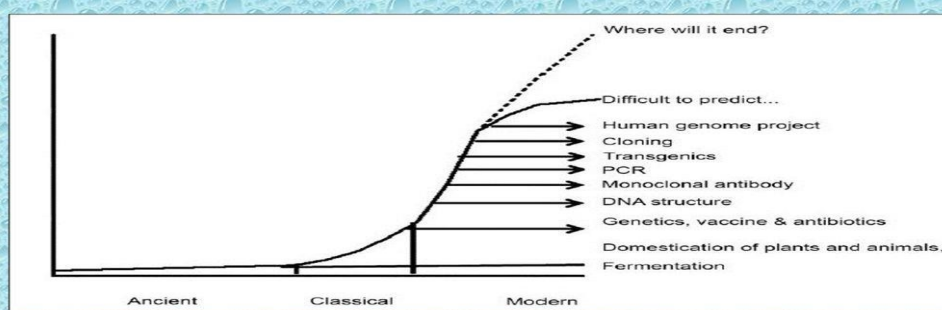


Figure 1: History of the development of biotechnology.

Another division for biotechnology was included:  
Ancient Biotechnology (stage I)  
Classical Biotechnology (stages II, III and IV)  
Modern Biotechnology (stages V and VI)

**The science of biotechnology is broken down into subdisciplines that are color-coded based on common uses and applications.**

- **Red biotechnology** involves medical processes, such as using organisms to produce new drugs and stem cells to regenerate damaged human tissues and grow and regrow entire organs.
- **White or gray** refers to industrial processes, such as the development of new chemicals or new biofuels for vehicles.
- **Green** covers agricultural processes, such as producing pest-resistant crops, disease-resistant animals and environmentally friendly agricultural practices.
- **Gold**, also known as bioinformatics, is a cross between biological processes and informatics. It refers to the methods healthcare workers use to gather, store and analyze biological data to treat patients.
- **Blue** encompasses processes in marine and aquatic environments, such as converting aquatic biomass into fuels and **pharmaceuticals**.
- **Yellow** refers to processes that aid food production, the most popular application being the fermentation of alcohol and cheese.
- **Violet** ensures the practice of biotechnology is in **compliance** with laws and ethical standards governing each field.
- **Dark** is the use of biotechnology for weapons or warfare.

