



THE CONTRIBUTION OF BIOTECHNOLOGY TO THE ADVANCEMENT OF SCIENTIFIC AND TECHNOLOGY RESEARCH

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Abstract

Development in biotechnology is defined as the advancement of technology for use in biological processes and the creation of goods with therapeutic applications. The term "biotechnology" was originally used in 1919 by Karl Ereky, a Hungarian engineer who also discussed the topic. Biotechnology, which combines technology with natural resources of organisms, is used in a variety of disciplines, including the production of plants and human medicine. All those who love bioscience have excellent employment opportunities thanks to biotechnology. In recent years, biotechnology has advanced and broadened its application in a number of scientific fields, including medicine, industry, agriculture, and environmental research. Every advancement in the biotechnological field has the potential to significantly benefit society and elevate standards of living. Biotechnology has developed and expanded recently in a number of areas that aid humanity in creating a seamless lifestyle system. The biotechnology industry can be categorised by colour and includes the bioinformatics (or gold biotechnology), biopharma (or red biotechnology), grey, green, white, blue, dark, violet, and yellow branches. Such colour allies are kept in place in biotechnology development as a result of the use of mice in several biological research with a focus on reproductive, neurological, cardiovascular, and cancer biology. By using these formats, researchers can better grasp biotechnology from a scientific perspective.

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Introduction

To advance national research in biology and biotechnology, the Indian government considered the need to establish a unique institutional structure in the 1980s. The following organisations supported modern biology research:

ICAR (Indian Council of Agricultural Research), ICMR (Indian Council of Medical Research), Department of Science and Technology, and UGC (University Grants Commission) are some of the organisations that conduct scientific and industrial research. The government created a different Department of Biotechnology (DBT) in February 1986 as a result of the National Biotechnology Board's accomplishments and influence. A technique that uses plants, animals, microorganisms, or biological processes with the goal of genetic changes through the utilization of living systems and their constituent parts in reference to improve human being life is referred to as biotechnology (Chawla, 2002). A lot of researchers are interested in biotechnology because it is used in many different branches of science and is not a particularly new field. Likewise, traditionalists contend that many biotechnology applications represent outdated methods that people have used to produce goods or carry out processes in an effort to enhance their lives, such as the manufacture of alcohol and wine.

On the other hand, modernists argue that new biotechnology using gene engineering will have the biggest influence on various fields of science, influencing society and economic systems (Dasilva *et al.*, 1992).

Beginning to be created and made accessible for medical use are novel therapies for numerous ailments that exploits bacteria as a raw material. In contrast with, some uses of gene engineering in the medical profession conflict with many cultural, moral, and religious values (Thieman and Palladino, 2004).

A often employed tool that may generate a wide range of goods and accomplish a number of worthy goals is biotechnology. The success of biotechnological applications, however, depends on the social structures and on how well-prepared the populace is for its effects. As a result, biotechnology is used in both science and technology, and there is debate regarding the effects that these two sectors have on one another. In the areas of health and crop productivity, these important aspects have both favourable and nonfavourable effects on both people and plants.

Role of Biotechnology for Humans - Field of Health :

The issues relating to human health and welfare have been While it has existed, mankind has been changed by it. It offers efficient methods for diagnosis, prevention, and

therapy, as well as the creation of new medications and recombinant vaccines considerably improved through biotechnology. With the goal of enhancing future technologies, there are so many research and study strategies being conducted. By developing food products like Golden Rice, potatoes, maize, groundnuts, and soybeans that have better nutrients, biotechnology has considerably contributed to enhancing human health. Vitamin A deficiency causes blindness in a large number of children in developing nations, and golden rice is high in this vitamin (Potrykus, 2001). vaccines produced through recombination, which have the capability to eliminate cancer a non-communicable diseases, have been created thanks to advances in biotechnology (Heim *et al.*, 2003). Infectious and parasitic disorders including tuberculosis (TB) and the Acquired Immunodeficiency Syndrome (AIDS) have been identified quickly and inexpensively. Polymerase chain reaction (PCR), among other molecular diagnostic methods (Lafeuillade and Stevenson, 2011). The most impactful vaccines against a variety of bacterial and viral illnesses are discovered to be those made from naked DNA, viral vectors, and plants (Javed *et al.*, 2015). The most crucial recombinant therapeutic protein for treating anaemia is erythropoietin. Interferon alpha has been developed to treat type 1 diabetes mellitus and viral illnesses as well as leukaemia

Growth hormone recombinant blood products, cytokines, gene therapy, monoclonal antibodies, products, molecular pharming agents, and engineered tissue goods are examples of other therapeutic agents. Heart valves, collagen, xenografts, and bone grafts have all been successfully created. Modern developments in biotechnology have decreased the amount of medication needed for a given treatment. GMCs (Genetically modified crops) are a useful byproduct of biotechnology that satisfy the body's need for vital vitamins and nutrients. They aid in the physical and intellectual growth of youngsters. New and desirable genes are entered into these crops which become nutritionally enriched to deal with expanding needs of health concern among the citizens worldwide. Examples include rice that is high in iron, which meets the need for iron and prevents anaemia.

Biotechnology Application in Plants- In the Field of Crop production:

The best definition of biotechnology is the use of scientific techniques to enhance and modify the importance of plants, animals, and microbes. Biotechnology has been a part of several industries over the years, including medical, agriculture, gene technology, etc.

You will learn about the use of biotechnology in agriculture and its importance in this article. The use of biotechnology on plants, particularly in relation to agriculture, is the most significant factor driving the region's or country's economic growth. One of the most crucial areas of genetic engineering in agriculture nowadays is the creation of genetically modified crops (GRACE, 2006). A set of scientific techniques that can enhance plants, microorganisms, and animals based on DNA and its ideas might be called as agricultural biotechnology. It might be argued that using biotechnology in agriculture is preferred over using agrochemicals. The latter is thought to be the culprit for environmental harm and is also fairly impractical

for farmers. The following highlight the few ways in which biotechnology has found its way in agriculture –

- **Gene technology/ rDNA technology :** This approach involves the purposeful lab modification of one or more genes. Recombinant DNA (rDNA) technology is used to do this, changing an organism's genetic make-up in the process.
- **Tissue culture :** Tissue culture have nurturing pieces of plant or animal tissue in a regulated environment where they stay to live and continue to grow. So the tissue firstly isolated for this.
- **Embryo rescue :** It falls within the category of plant in-vitro culture. Here, to improve the chances of survival, a developing embryo is reared in a controlled environment. This might help protect seed species that are at danger of extinction. They could be culturally significant local grains, heirloom seeds, etc.
- **Somatic hybridisation :** It is a procedure through which the cellular genome is changed through the process of protoplast fusion.
- **Molecular-gene markers :** Molecular-gene markers are distinct DNA segments used in genetic engineering that are linked to particular regions of the genome (Gilbert, 2001).
- **Molecular diagnostics :** Molecular diagnostics is a set of methods used to study biological markers in the genome and proteome. Thinking about how their cells express their genes as proteins is helpful.

Vaccine

It is a mixture that is injected into the body of the host in order to trigger the desired immunological response. It aids in the prevention of many illnesses, including polio. To combat COVID, it is presently produced in large quantities.

- **Micropropagation**

It is the aseptic and controlled clonal multiplication of plants in a closed vessel.

Importance of of Biotechnology in Agriculture

The role of biotechnology in agriculture is complicated. Some of the most ubiquitous benefits of biotechnology in agriculture include –

I. Enhancement in Crop Production

By strengthening disease prevention and resistance to drought and flooding, biotechnology dramatically raises agricultural productivity. This helps farmers cut losses while simultaneously meeting the growing demand for food.

II. Better Crop Protection

Biotechnology techniques offer practical, affordable answers to pest control issues. Farmers have developed a protein that effectively combats pest problems from crops like cotton, corn, and potato.

III. Increase in Nutrition Value

Also, it has made it possible for farmers to grow crops with better flavour, texture, and nutritional value. For instance, technological advancements have made it feasible

to grow potatoes with starch and soybeans with high protein content.

IV. Fresher Produce and Better Taste

By boosting the activity of enzymes found in plants, it also contributes to enhance the flavour and taste of crops. Moreover, it keeps the harvest fresher for longer.

V. Chemical Tolerance

Herbicides are used by the majority of farmers to prevent weed development, which frequently causes soil erosion. But because genetically modified food is resistant to a number of chemicals, including herbicides, the amount of soil erosion is greatly reduced.

VI. Disease Resistance

In addition to the fact that insecticide use frequently threatens the quality of the soil and the crop, viral diseases spread by insects are frequently challenging to control. Yet, genetically modified plants are less prone to virus contamination and help farmers control crop loss.

Although using biotechnology in agriculture has many advantages, it is not without drawbacks. To elaborate, there are certain worries regarding societal, environmental, and health concerns.

Among the many concerns surrounding the use of biotechnology in agriculture are resistance to antibiotics, pesticide, superweed development, and biodiversity loss. Yet, one can expect that as technology develops, researchers will discover workable solutions.

Conclusion

According to the information given above, biotechnology has a significant impact on all facets of human health. Modern medical devices, such as vaccinations, diagnostic test kits and radio-labeled biological therapies utilised for imaging and analysis are readily available for diagnostic and preventive purposes thanks to biotechnology. Malnutrition mostly occurs from a lack of vital vitamins and nutrients in meals and causes death. By creating foods like

Golden Rice, Maize, Potato, and Soybeans, among other nutrient-rich foods, biotechnology has significantly contributed to the elimination of these issues. Untreated garbage and pollutants pose a serious threat to human health and may contribute to cancer. Using microorganisms, biotechnology has developed a variety of methods to biodegrade harmful contaminants. The two main benefits of biotechnology are the precipitation of heavy metals and the bioremediation of contaminants.

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