A Review on Biotechnology and its Future Scope

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Abstract - *Biotechnology is a term that refers to various procedures—converting living organisms for human purposes. Four distinct pillars support it: medical biotechnology, industrial biotechnology, agriculture biotechnology, and marine biotechnology, and interestingly, they are categorized according to color. Medical biotechnology color is red, and industrial biotechnology color is white. Likewise, agricultural biotechnology is green, and marine biotechnology is blue. Although there are several methods for classifying biotechnology, using a color code is the most common. This is used to make it easier to remember how to categorize the various fields of biotechnology study. In the upcoming years, biotechnology will be a survival tool for an increasing number of different types of significant diseases and pandemics. It has also expanded to the health sector, like Pharmaceutical Biotechnology, in which biotechnology principles are used in the development of drugs. Through genetic engineering, we can alter the genetic makeup of an organism. Scientists have developed new medications and drugs, including human growth hormone and insulin.*

There are more than 2000 biotech start-ups and 3000 biotech companies in India. India has 665 FDA-approved factories. The country is in second place for manufacturing BT cotton and is the third-largest producer of recombinant Hepatitis B vaccine globally (genetically modified pest-resistant plant cotton). In October 2021, Amgen, a USA-based biopharmaceutical company, obtained all shares of Teneobio. Amgen acquired Teneobio's multi-specific antibody technologies. This will help discover treatments for a wide range of illnesses. The countries covered in the biotechnology market are Australia, Brazil, France, Germany, India, Indonesia, Japan, the UK, the USA, etc.

Key Words: Genetic Engineering, Plant Biotechnology, Pharmaceutical Biotechnology.

1. INTRODUCTION

Biotechnology combines scientific and engineering applications to perform biological materials and provide goods and services. It can also be defined as the skills necessary to use living systems or natural influence processes to create products, procedures, or environments to support their development. Living organisms are used to make or transform a consequence, improve animals and plants, or design drugs for specific uses [1]. There are many different types of biotechnology; they are categorized according to color. Firstly, red biotechnology, which is medicinal biotechnology, is used in drug development, pharmaceutical industry, producing vaccines and antibodies, molecular diagnostics techniques, and also helps in the development of genetic engineering to cure diseases through genetic disorders. Secondly, White Biotechnology, also known as Industrial Biotechnology, in which microorganisms are used in chemical production, living cells extracted from sources such as plants and yeast, creates products that need fewer resources. They also produce new plastics and biofuels during their production, resulting in less waste. The third type is green biotechnology, which is also called agricultural biotechnology. Agricultural Biotechnology and Environmental Biotechnology are divided into two parts. Agricultural biotechnology mainly focuses on technologies related to producing more vital crops or creating new bio-pesticides to reduce the number of chemicals needed. It also helps with plant growth and improves crop yields. Environmental biotechnology focuses explicitly on ecological problems such as pollution removal, renewable energy generation, and converting plants into biofuels. It is also trying to produce bio-plastic that is helpful to the environment and can reduce waste—production of biogas or other natural sources of energy. Last, Blue Biotechnology, also known as Marine Biotechnology, focuses on marine organisms that can be used for various human purposes, such as developing medicine and enhancing human health. It is used in the production of human painkillers, which can be extracted from the venom of cone snails. Blue Biotechnology is responsible for the mass production of proteins, enzymes, and biomaterials [2].

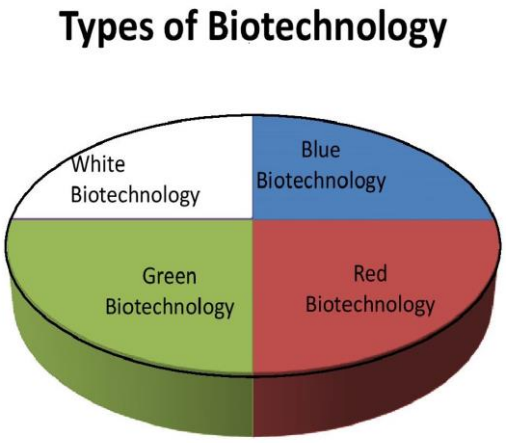

Figure 1

2. Different types of Biotechnology

2.1 Red Biotechnology

Red biotechnology (Medical biotechnology) is a process in which organisms enhance the health sector. This branch is

also focusing on the development of medicines and drugs. This branch focuses not only on the pharmaceutical industry but also on the medical industry to enhance the quality of life. It is used in gene therapy, genetic engineering, and drug development. These are all parts of Red Biotechnology. It can also find the best medicine dosages for patients with the help of their genetic code. This advanced technology will upgrade the medical sector so that doctors will diagnose patients in a more personal way by using red biotechnology. Scientists use biological materials used to find health-related crises like antibodies production from genetically-modified cells. Red Biotechnology is a research-oriented field. For instance, genetic engineering is used for the detection of various diseases and also to find the cure for that disease. 3D printing in biomedicine is the future of red biotechnology. This technology can build human organs using human cells. This high-tech revolution could evolve the medical sector [3].

2.2 Green Biotechnology

Green biotechnology is divided into two categories: environmental biotechnology and agricultural biotechnology. Agriculture biotechnology is primarily concerned with developing more robust crops and bio-pesticides. Global agricultural productivity has benefited the country by bringing crop varieties that are resistant to pests and diseases. This technology is also used in plant tissue culture to cultivate plant seeds, tissues, cells, and explants under controlled conditions and temperatures [4]. In green technology, genetic engineering plays a minimal role. In this technique, the desired gene is transferred from one organism to another to improve crop quality and modify plants to provide health benefits such as increasing food's vitamin and mineral content.

Secondly, environmental biotechnology is also a part of green biotechnology, which works to protect and restore environmental quality. The main agenda of ecological biotechnology is to clean up pollution, wastewater treatment, and air purification by exploiting biological processes. This technology can detect the emission of pollutants into the environment. There are many benefits to green biotechnology; they make the environment safer and cleaner. Examples are biomarkers, biosensors, biofuels, etc. [5]. The latest research is on CRISPR-based kill switches for engineered microbes.

2.3 White Biotechnology

Industrial biotechnology is also called white biotechnology, which consists of using cells extracted from plants and yeast to create products that need less energy during production. They also try to produce less waste. Bacterial enzymes are widely used to deliver active ingredients in washing powders. *Escherichia coli* is used to produce human insulin, which will help to lower your blood glucose levels. White biotechnology also brings many advancements in the chemical, food, packaging, and health industries. There has been a tremendous amount of recent scientific development in industrial processing and biorefining[6].

2.4 Blue Biotechnology

Blue biotechnology is also called marine biotechnology; this technique mainly focuses on producing alternative energy sources of Biofuel is one of the significant examples of blue biotechnology. It consists of a study of marine organisms, which helps humans in medicine production and food production helps to enhance human health. Marine biotechnology uses an enormous variety of organisms to produce nutraceuticals, pharmaceuticals, clothes. Blue biotechnology is also involved in the environment and health sectors; there have been various developments in making drugs and painkillers. They are derived from flora and fauna. There is also the use of high-resolution biosensing techniques to monitor marine environments.

Furthermore, industrial sectors benefit from marine biotechnology because humans consume every product. The marine ecosystem generates many proteins, enzymes, biopolymers, bio-adhesives, and biomaterials. Green fluorescent protein from jellyfish is a notable example of marine biotechnology products, both of which are used as reporter proteins in molecular biology. A transgenic fish has been genetically modified. Gene delivery is one of the significant applications of Blue Biotechnology; they are also being developed as environmental pollutant indicators in aquatic habitats. These modified fish are used in scientific research and studies for various purposes, including improving the traits of commercially available fish.[7] Marine biodiversity and genetic diversity have provided potential biotechnological applications in bioprospecting, drug discovery, environmental remediation, increasing seafood supply and safety, and developing new resources and industrial processes. Blue biotechnology has a significant impact on the blue economy because it is primarily responsible for exploiting and preserving the marine ecosystem. As a result, blue biotechnology is increasingly seen as a technically and commercially viable development path.

3. Recent trends in biotech

The advancement in computer technology such as artificial intelligence (AI) and machine learning is expanding in the field of Biotechnology and also improving efficiency in the manufacturing process. For instance, in the medical field, the ability to analyze large data sets assists drugs in identifying treatments based on disease cause. Furthermore, the updation in cloud technology is the ability to run the software and analyze the data, which can be accessed from anywhere [8].

Biotechnology in Environment - Biotechnology is now assisting us in controlling environmental pollution through biodegradation of potentially harmful its helps us recycle waste materials and other waste treatment technologies.

Biotechnology plays an essential role in monitoring and preventing decay through biological applications such as bioremediation, bio-monitoring, bio-treatment, and biodegradation of all toxic gaseous, solid, and liquid wastes. Aside from these advantages, several other biotechnological treatments are used to monitor the various components of the environment.

Biotechnology in pharmaceuticals – Biotechnology plays a vital role in the medical sector. Biotechnology is used in the diagnosis, treatment, and prevention of diseases. Biotechnology is helping us in the treatment and prevention of many diseases; it also helps in the development of drugs and recombinant vaccines that can cure human diseases.[9]

3.1 Trends in biotechnology in year 2021-2022

1) Gene Editing:- Gene editing is also known as genetic engineering which is a modern technology. This technique eliminates defective gene and placed it with desired gene. The development of engineered nucleases has increased gene editing efficiency, and CRISPR is now being used as molecular scissors in the healthcare industry. This editing technology has enabled various applications in the field of gene therapy to treat genetic disorders and other linked connections that include complex editing techniques for adding, replacing, or silencing specific genes.

2) Bio-printing:- This technique is used in building tissue and organ structure bio-printers that work with existing bio-inks made from biomaterials. These cells will act as substrates and grow around a scaffold, allowing the development of various body parts from the patient's cells, such as bone skin, etc.

3) Telemedicine:- Telemedicine technology is the future of the health and care industry. It is defined as medical personnel treating and diagnosing by keeping their distance from the patients. There are many telemedicine software like Doxy.me, OhMD, Whereby, Mend, Updox, etc[10].

4. Future Scopes in Biotechnology

Biotechnology is a vast domain that encompasses many aspects of modern life and provides numerous opportunities for employment and career advancement. This is due to the current need, use, and demand for biotechnology. India is a developing country on its way to becoming the world's major hotspot for the biotechnology industry. Why? Because India has a massive Medicine industry with ties to major countries worldwide, a thriving agricultural sector produces more efficient hybrid crops and farming methods, genetic research and development, and a booming healthcare industry cannot thrive without Biotechnology. As a result, biotechnology will play a critical and significant role in career opportunities and job creation in the coming years [11].

4.1 Future of biotech in India?

Pharma: India accounts for 20% of global generic medicines market exports in volume, making it the world's largest provider of generic drugs, with plans to expand even further in the coming years. Bio-agriculture: In India, genetically modified crops cover 11.57 million hectares of land, with Bt cotton dominating. India has the potential to become a producer of transgenic rice and a variety of genetically modified (GM) or engineered vegetables. With all of this, India needs its young and intellectual minds to lead the future of biotechnology - someone who believes that "the best way to predict the future is to create it." Many Indian scientists and researchers with extensive industry and entrepreneurial experience have relocated to other countries [12]. We need to develop new programs and incentives to entice them to return home (or take consulting roles for young Indians). This initiative will provide the market with valuable human resources to launch new businesses or fill specific skill gaps in established industries.

5. CONCLUSION

Biotechnology has enormous potential for increasing food production and improving food processing, but the actual impact will not be felt until after 2000, and it will vary by country. Productivity in developed countries must first rise before real benefits can be realized in developing countries. When biotechnologies are used in domestic production, "demonstration effects" can stimulate development in other countries. In this case, developing countries have a lot of room to work together. However, where the application of this new technology aims to increase productivity in export sectors, success in some countries may come at the expense of others' market position. In such a case, international competition may jeopardize developing-country cooperation, which appears to be essential.

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