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BIOTECHNOLOGY APPLICATIONS IN MEDICINE

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ABSTRACT

Today, medical science uses biotechnology to determine the most radical manifestations of diseases and work out their cure. With the discovery of the complete sequence of the human genome in 2001, biotechnologists are going to find genes in different traits and defects. Many genes that cause the development of diseases have been identified including for Cancer, cardiovascular, respiratory, mental disease. Highly selective and effective medications (tailor made) to cope with disease are provided by detection of individual genes and their derived proteins. This paper explores biotechnology and its impact on medical sciences.

Keywords: Biotechnology, Genomics, Proteomics, Recombinant Vaccines

Introduction

The term 'biotechnology' was coined by Hungarian engineer Karl Ereky, in 1919, to refer to the science and methods that permit products to be produced from raw materials with the aid of living organisms. Biotechnology is a diverse field which involves working with living cells or using molecules derived from them for application oriented toward human welfare, using varied types of tools and technologies. It is an amalgamation of biological science with engineering whereby living organisms or cells are used for production of products andservices.

The main subfields of biotechnology are medical (red) biotechnology, agricultural (green) biotechnology, industrial (white) biotechnology, marine (blue) biotechnology, food biotechnology and environmental biotechnology. In this paper, we explore the potential applications of biotechnology in several fields like production of medicines; diagnostics; therapeutics like monoclonal antibodies, stem cells, and gene therapy; agricultural biotechnology; pollution control (bioremediation); industrial and marine biotechnology; and biomaterials, as well as the ethical and safety issues associated with some of the products.

Background

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Biotechnology came into being centuries ago when plants and animals began to be selectively bred and microorganisms were used to make beer, wine, cheese, and bread. The field gradually evolved, and presently is used for manipulation of living organisms to produce beneficiary substances which may have medical, agricultural, and/or industrial utilization. Conventional biotechnology is referred to as the technique that makes use of living organisms for specific purposes as bread/cheese making, whereas modern biotechnology deals with the technique that makes use of cellular molecules like DNA, monoclonal antibodies, biologics, etc.

The foundation of modern biotechnology was laid down after the discovery of the structure of DNA in the early 1950s. The hereditary material is deoxyribonucleic acid (DNA) which contains all the information that dictates each and every step of an individual's life. The DNA consists of deoxyribose sugar, phosphate, and four nitrogenous bases (adenine, guanine, cytosine, and thymine). The base and sugar collectively form nucleosides, while base, sugar, and phosphate form nucleotides. These are arranged in particular orientation on DNA called order or sequence and contain information to express them in the form of protein. DNA has double helical structure, with two strands being complementary and antiparallel to each other, in which A on one strand base pairs with T and G base pairs with C with two and three bonds, respectively. It is the long but compact molecule which is nicely packaged in our nucleus. The DNA is capable of making more copies like itself with the information present in it, as order or sequence of bases. This is called DNA replication.

When the cell divides into two, the DNA also replicates and divides equally into two. DNA contains whole information for the working of the cell. The part of the DNA which has information to dictate the biosynthesis of a polypeptide is called a "gene." The arrangement or order of nucleotides determines the kind of proteins which we produce. Each gene is responsible for coding a functional polypeptide. The genes have the information to make a complimentary copy of mRNA. The information of DNA which makes RNA in turn helps cells to incorporate amino acids according to arrangement of letters for making many kinds of proteins. These letters are transcribed into mRNA in the form of triplet codon, where each codon specifies one particular amino acid. The polypeptide is thus made by adding respective amino acids according to the instructions present on RNA. Therefore, the arrangement of four bases (adenine, guanine, cytosine, and thymine) dictates the information to add any of the 20 amino acids to make all the proteins in all the living organisms. Few genes need to be expressed continuously, as their products are required by the cell, and these are known as "constitutive genes." They are responsible for basic housekeeping functions of the cells. However, depending upon the physiological demand and cell's requirement at a particular time, some genes are active and some are inactive, that is, they do not code for any protein. The information contained in the DNA is used to make mRNA in the process of " transcription". The information of mRNA is

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used in the process of " translation" for production of protein. Transcription occurs in the nucleus and translation in the cytoplasm of the cell.

In translation several initiation factors help in the assembly of mRNA with 40S ribosome and prevent binding of both ribosomal subunits; they also associate with cap and poly(A) tail. Several elongation factors play an important role in chain elongation. Though each cell of the body has the same genetic makeup, but each is specialized to perform unique functions, the activation and expression of genes is different in each cell. Thus, one type of cell can express some of its genes at one time and may not express the same genes some other time. This is called "temporal regulation" of the gene. In the body different cells express different genes and thus different proteins. For example, liver cells and lymphocytes, would express different genes. This is known as spatial regulation of the gene. Therefore, in the cells of the body, the activation of genes is under spatial regulation (cells present at different locations and different organs produce different proteins) and temporal regulation (same cells produce different proteins at different times). The proteins are formed by the information contained in the DNA and perform a variety of cellular functions. The proteins may be structural (responsible for cell shape and size), or they may be functional like enzymes, signaling intermediates, regulatory proteins, and defense system proteins. However, any kind of genetic defect results in defective protein or alters protein folding which can compromise the functioning of the body and is responsible for the diseases.

Discussion

Biotechnology in Medicin

Medical biotechnology is a branch of medicine that uses living cells and cell materials to research and then produce pharmaceutical and diagnosing products. These products help treatand prevent diseases. From the Ebola vaccine to mapping human DNA to agricultural impacts, medical biotechnology is making huge advancements and helping millions of people. Some of the most recent uses of biological tech is work in genetic testing, drug treatments, and artificial tissue growth. With the many advancements in medical biotechnology, new concerns like the source of funding and ethics, are becoming a huge part of the discussion.

Cancer research, agricultural advancements, medical biotechnology has many promisingavenues of technological growth that have the potential to help many people.

- **CRISPR**

Clusters of Regularly Interspaced Short Palindromic Duplications or CRISPR is a technologythat can edit genes. CRISPR is a family of DNA sequences initiated in the genomes of prokaryotic

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organisms connoted as bacteria and archaea. These sequences are extrapolated from DNA fractions of bacteriophages that had anteriorly infected the prokaryote. They're used to determine and destroy DNA from connate bacteriophages during ensuing infections. CRISPR is constituted in much 50% of sequenced bacterial genomes and nearly 90% of sequenced archaea. Of course, pharmaceutical companies and other scientific brotherhoods that develop and exploit CRISPR technology are trying to de-emphasise the firms and issues, so the reality of the benefits and damage of the technology is unknown.

- **Tissue Nano Transfection**

Science in contemporary times has the potential to heal people in single contact. This sounds too good to be true but with the rate at which technology is growing, it’s a near reality. Tissue nano transfection works by injecting genetic code into an individual’s skin cells. This turns those cells into alternate types of cells which can remedy diseases. In a few laboratory tests, a single touch of TNT managed to completely heal the wounded legs of mice over the duration of some weeks. This happened by turning skin cells into vascular cells. It is reported that biotech has the aptness to work on other types of tissue, in addition to skin. Continued research and testing will only serve to improve this technology which will help save precious human lives. Medical biotechnology has made gene therapy huge. Its applicability is vast. It can save car crash victims as well as active duty soldiers.

- **Recombinant DNA Technology**

Recombinant DNA technology refers to combining DNA molecules from two different species and subsequently inserting that new DNA into a host organism. This leads to the production of new genetic combinations for medicine, agriculture, and industry. Recombinant DNA technology is vastly used. For instance, it is used in biopharmaceuticals and diagnostics, application of energy like biofuel, agricultural biotechnology which involves fruits and vegetables being modified. Regular medicine or produce pales in comparison to genetically modified products. This is due to higher pest resistance and weather resistance; better work of recombinant medicine like insulin with bodies, etc. Due to the many benefits that recombinant DNA holds for a variety of products, researchers are positive about the space it will occupy within biosciences and other industries in the future.

- **Genetic Testing**

Genetic and ancestry kits have gained newfound popularity. They not just help people understand their genetics and heritage, but new studies have shown that saliva kits have the capability to test for things like breast cancer by taking gene mutations into consideration. Since certain races are more likely to inherit certain mutations or human diseases, knowing the races which make up your genetic material can help you devise a plan to be prepared.

- **Genomics**

Genomics involves studying all the genetic material of an animal, plant or microbe. The Human Genome Project is one of the most famous genomics endeavors. Its goal is to uncover the human genetic code, with an aim to find the origins of certain conditions and behaviors. Scientists are also involved in investigating the genetic composition of other animal species, plants, bacteria, viruses, funguses, insects and nematodes in addition to human DNA, so that they are able to generate innovative products and techniques. Due to successful genomic research, the field of bioinformatics which allows scientists to store, analyze, compare and apply this information has been established.

- **Proteomics**

Proteomics is the term used for the study of proteomes and their functions. The entire set of proteins produced or modified by an organism or system is referred to as a proteome. They facilitate the identification of an ever-increasing number of proteins. This is varied since an organism or cell undergoes stresses. Projects like the Human Genome Project have contributed to the success of Proteomics as an interdisciplinary domain. Proteome research, from composition to structure and activity is a salient component of functional genomics.

- **Recombinant Vaccine**

Recombinant vaccines can be expressed in the form of both DNA and proteins. Since the DNA version is cost-friendly when it comes to production and is thermostable, it does not require the "cold chain" for transportation and preservation. DNA vaccines have been the subject of study of a large number of research studies. However, only a few DNA vaccines have succeeded in being used by human beings.

Conclusion

Advances in molecular biology are not comparable to any other epoch. Development of biotechnology and inborn engineering led to the development of other sciences such as specific microbiology, husbandry and pets. Presently, yield of DNA vaccines and recombinant vaccines are an important way towards the precluding of vaccine-preventable troubles. In cases where there's an inherited scar in the yield of hormones or enzymes, new bio-pharmaceutical ways are a beacon of hope. Future of biotechnology and pharmaceuticals will be very promising. We can

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hope that many diseases and genetic defects will be treated and mankind will vastly be benefitted.

Bibliography

1. Chilkoti, A., Christensen, T., MacKay, A. *Stimulus Responsive Elastin Biopolymers: Applications in Medicine and Biotechnology*, Science Direct, December 2006 (Volume 10, Issue 6). https://www.sciencedirect.com/science/article/abs/pii/S136759310600161X

2. Caruthers, SD., Wickline, SA., Lanza, GM, *Nanotechnological Applications inMedicine*, Science Direct, February 2007, (Volume 18, Issue 1). https://www.sciencedirect.com/science/article/abs/pii/S0958166907000079

3. Erickson, T., *Production of Phycocyanin—A Pigment with Applications in Biology, Biotechnology, Foods and Medicine*, Science Direct, 1st August 2008. https://link.springer.com/article/10.1007/s00253-008-1542-y

4. Mohammad, Z and Dr. Narasu,. *A Review Article: Biotechnology Applications in Medicine*, International Journal of Applied and Basic Sciences, 2013. https://d1wqtxts1xzle7.cloudfront.net/56885774/cd817fd7423cdad8a26a6f5a546bf2a5d9db-with-cover-page-v2.pdf?Expires=1633852986&Signature=XGhwoCr~sl9599R6DXnZNmDIV0Tn8Ex530rx~dHPXSmmuq7yMp~~XUrpSPOU7hHze4g969~o1pLBXMxkr7Jl34dqtKnX~ySvSnxkDMGkoWO3KmE4AweMlGvjZ4rsW0X32f~RxU-vrvqcrvJzelSQXeyUMyf8oS8YcEY9N1CLGf~45qk~97pVC0wpPCwmGpbOq1v1k1ZwGToKzchLvFPPSByRvEJKpFZzJzBaPRCrBHGHpxM-C2CT2w~eH5IqFtzsElRmCZ-LYxq6vlqsqdxVerJbT8FskEPNcy3CRYSm1IuqxWFjI53Bt3R4VbU5hWAumT422I~44ecYLCpfVHvh7A__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA

