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Recombinant DNA Technology: A New Approach in Genetics

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INTRODUCTION

Three elements have a significant impact on human life: food scarcity, health problems, and environmental concerns. Aside from a clean and safe environment, food and health are essential human needs. Human food requirements are rapidly increasing as the world's population grows at a faster rate. Humans demand food that is both safe and affordable. Several human-related health conditions cause a substantial number of deaths around the world. Non-communicable and communicable diseases, such as cardiovascular disease, cancer, diabetes, AIDS/HIV, tuberculosis, and malaria, kill millions of people each year. Despite significant efforts, present global food production falls well short of human needs, and health-care facilities in third-world countries are far worse. Rapid industrialisation has increased environmental contamination, and industrial wastes are permitted to mix directly with water, affecting aquatic marine life and, indirectly, humans. As a result, modern technology must be used to overcome these difficulties. Unlike traditional approaches to overcoming agriculture, health, and environmental issues through breeding, traditional medicines, and pollutants degradation through conventional techniques, genetic engineering makes use of modern tools and approaches, such as molecular cloning and transformation, which are faster and produce more reliable results. In contrast to traditional breeding, which transfers a large number of both particular and nonspecific genes to the recipient, genetic engineering simply delivers a small block of desired genes to the target by various methods such as biolistic and Agrobacterium-mediated transformation. Homologous recombination-dependent gene targeting or nuclease-mediated site-specific genome editing are both used to modify plant genomes. It's also possible to use recombinase-mediated site-specific genome integration and oligonucleotide-directed mutagenesis.

Recombinant DNA technology is playing a vital role in improving health conditions by developing new vaccines and pharmaceuticals. Diagnostic tools, monitoring equipment, and new therapeutic approaches are all being developed to improve treatment strategies. One of the most prominent examples of genetic engineering in health is the development of new types of experimental mutant mice for research purposes and the synthesis of synthetic human insulin and erythropoietin by genetically engineered bacteria. Similarly, genetic engineering technologies have been used to address environmental concerns like converting wastes into biofuels and bioethanol, cleaning oil spills, carbon, and other toxic pollutants, and so on. Arsenic and other pollutants in drinking water are being detected. Microbes that have been genetically engineered are also efficient in Bio mining and bioremediation are two terms that are used interchangeably.

Recombinant DNA technology comprises altering genetic material outside an organism to obtain enhanced and desired characteristics in living organisms or as their products. This approach includes inserting DNA fragments from a number of sources into an appropriate vector with a desired gene sequence. Manipulation of an organism's genome can be done by adding one or more new genes and regulatory elements, or by recombining genes and regulatory elements to reduce or prevent the expression of endogenous genes.

APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY

Food and agriculture

Recombinant DNA technology has a wide range of applications, including the development of novel enzymes

that are suited for certain food processing conditions. Because of their specialised roles and applications in the food industry, several key enzymes such as lipases and amylases are accessible for specific manufactures. Another significant development made feasible by recombinant DNA technology is the generation of microbial strains. A number of microbial strains have been produced that manufacture enzymes as a result of particular engineering for protease synthesis. Plants have been used to make a variety of therapeutic protein products, including casein and lysozyme for improving children's health and protein polymers for tissue replacement and surgery. Tobacco plants can also be genetically modified to make human collagen. One of the primary objectives in the realm of recombinant DNA technology is to produce high yielding molecular proteins.

Health and disease

Recombinant DNA technology has a wide range of applications in the treatment of diseases and the improvement of health. Gene therapy is an advanced medical method with therapeutic potential. The first successful report in the field of gene therapy for the treatment of a genetic condition gave a more secure path toward healing the most lethal hereditary diseases. This method has shown to be effective in treating diseases caused by immunodeficiency. The importance of investigating the complex system of drug metabolising enzymes involved in drug metabolism is critical for the optimal efficacy and effects of medications. Heterologous expression, in which the enzyme's genetic information is expressed in vitro or in vivo via gene transfer, has recently played a role in recombinant DNA techniques.

Environment

Genetic engineering has wide applications in solving the environmental issues. *Pseudomonas fluoresces* strain designated HK44, for bioremediation purposes is one of the example. For the detection and absorption of pollutants in drinking water and other samples, genetic engineering has been widely applied. Hydrogen synthesis is mediated by several microorganisms, including cyanobacteria, which is an environmentally favourable energy source. The specific production is maintained by effectively employing the essential enzymes, which play an important part in product synthesis. However, advanced techniques including as genetic engineering, nutrition and growth environment manipulation, mixed culture, metabolic engineering, and cell-free technologies are available.

CONCLUSION

Recombinant DNA technology is a significant advancement in science that has made life considerably easier for humans. It has expanded tactics for medicinal applications such as cancer treatment, genetic diseases, diabetes, and a variety of plant ailments, particularly viral and fungal resistance, in recent years. The importance of recombinant DNA technology in cleaning up the environment and improving plant tolerance to many adverse circumstances has long been acknowledged. It made major advancements not just in people, but also in plants and microorganisms.