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Commentary

The Role of Genetic Engineering in Developing New Drugs and Diagnostics

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DESCRIPTION

Genetic engineering is a field of biology that involves the manipulation of genetic material to modify the characteristics of an organism. This process can be used to produce organisms with desirable traits, such as increased disease resistance or improved nutritional content, or to study the functions of genes and their interactions. Genetic engineering involves the use of molecular biology techniques to alter the Deoxyribonucleic acid (DNA) of an organism. This process can be achieved in several ways, including the use of recombinant DNA technology, gene editing, and gene therapy [1].

Recombinant DNA technology involves the insertion of foreign DNA into the genome of an organism. This technique is commonly used in the production of genetically modified (GM) crops, which are designed to be resistant to pests, diseases, or herbicides [2]. The process involves isolating a gene of interest from one organism and inserting it into the DNA of another organism, where it can be expressed and produce the desired trait.

Gene editing involves the use of molecular scissors, such as Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR/Cas9), to precisely edit the DNA of an organism [3]. This technique has revolutionized genetic engineering by allowing scientists to make precise changes to the DNA of an organism, including the addition, deletion, or modification of specific genes. Gene editing has applications in a variety of fields, including agriculture, medicine, and biotechnology [4].

Gene therapy involves the insertion of normal genes into the cells of an individual to treat or prevent disease. This technique is still in its early stages of development but has shown promise in the treatment of genetic disorders, such as cystic fibrosis and sickle cell anaemia [5].

Genetic engineering has numerous applications in agriculture, medicine, and biotechnology. In agriculture, genetic engineering has been used to produce crops that are more resistant to pests and diseases, have increased nutritional content, and are able to grow in harsher environments [6,7]. For example, GM crops such as *Bacillus Thuringiensis* (BT) cotton and BT corn are genetically engineered to produce a protein that is toxic to certain pests, reducing the need for pesticides [8-10].

In medicine, genetic engineering has the potential to revolutionize the treatment of genetic disorders, cancer, and infectious diseases. Gene therapy has shown promise in the treatment of genetic disorders, such as cystic fibrosis, and cancer, where it can be used to target specific genes that are responsible for the development of cancer cells [11,12]. Gene editing is also being explored as a potential cure for Human immunodeficiency virus (HIV), as it can be used to remove the virus from an infected individual's DNA. In biotechnology, genetic engineering is being used to develop new drugs, vaccines, and diagnostic tools. For example, genetically engineered bacteria are being used to produce insulin, a hormone used to treat diabetes. This process involves inserting the gene that codes for insulin into the DNA of bacteria, which can then produce large quantities of the hormone [13].

Despite its potential benefits, genetic engineering also raises ethical and safety concerns. One of the main ethical concerns is the potential for genetic engineering to be used for non-medical purposes, such as the creation of "designer babies." This could lead to a society where only those who can afford to have their children genetically modified have access to the most desirable traits [14].

Another concern is the potential for unintended consequences. Genetic engineering can have unforeseen effects on the environment and on other organisms in the ecosystem. For example, the use of GM crops could lead to the development of pesticide-resistant pests, creating new environmental problems.

There is also concern over the safety of Genetically Modified Organisms (GMOs) in the food supply. While GMOs have been deemed safe by regulatory agencies, some studies have raised concerns about the potential health effects of consuming GMOs over the long term [15].

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