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How does CRISPR work and how does it relate to ethics

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ABSTRACT

Thanks to the many ongoing research pieces in the field, it seems that the future of dentistry will be incredibly bright. Read on to learn more.

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Introduction

The discovery of DNA has enabled us to understand more about the working mechanism behind all life.Since then, we've accomplished huge leaps in technology that have opened up avenues in genetics, evolution, pharmacology, and now, gene editing.

Perhaps the most significant breakthrough in gene editing comes with CRISPR. Let's explore how CRISPR works and why we have to face the ethicsbehind its use.

What is CRISPR?

Clustered Regularly Interspaced Short Palindromic Repeats, or CRISPR for short, is a relatively new technology originally discovered in the bacterial immune system in 2007. A decade later, scientists at the University of Tokyo and Kanazawa University showed it in action, leading to further genomic research.

CRISPR works in tandem with a protein and an RNA molecule forming a complex that bind and cut specific sections in the DNA. Bacteria use it to place new sections in their DNA to ward off viral attacks, but researchers are looking to enhance its function other than just molecular scissors.

The Potential of CRISPR

Once the complex is activated, it binds to a specific target location in the genome called a PAM, based on the guide RNA. After successful attachment, the RNA molecule unravels the DNA molecule and binds with the nucleotides in it. The CAS-9 protein then places a cut at the location. If two CRISPR-CAS9 complexes are used in parallel, defective genes can be effectively cut from the genome, allowing cell repair mechanism to fix them.

Some researchers are playing with the functions that CAS-9 can perform and fitting enzymes onto the protein rather than cutting domains. These enzymes can then be transported to target individual nucleotides in the genome and edit them to desired ones. There by mutating the structure of DNA to fix genetic disorders and hereditary conditions.

Since genes are the building blocks of all life, we don't know how CRISPR will affect genetically modified crops. Plants can readily disperse their genes into their surroundings via pollen and seeds; we can't be sure as to how CRISPR enhanced crops willaffect unaltered plants in our ecosystem.

Figure 1.

A tool kit in a dentistry clinic

Other research involves promoting gene expression. Instead of enzymes or cutting domains, transcriptional activators, molecules that promote gene transcription, can be attached to the

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CAS-9 complex in a variety of ways. This process enables intracellular molecules to readily bind with a certain gene and churn out RNA, elevating the function of that gene. In contrast, molecules can be added that inhibit or suppress a gene by preventing RNA molecules from binding to a gene. Either way, this process can help us control genes to advance cellular function, control diseases, and cure genomic conditions.

The Role of Ethics in CRISPR

The way CRISPR works allows us the ability to control genomic architecture. It is a sensitive topic in the scientific community because of the uncertainty behind the effects of gene editing, its impact on organisms, and how it will translate into future generations.

The procedure will be costly as it requires molecules to be tailor-made to a specific person's genome. This entails that the technology will only be accessible to those who have the means to secure it. Many fear that CRISPR may result in a future where a certain segment of society can attain superhuman capabilities by enhancing traits that further their strength, intelligence, or beauty.

Since genes are the building blocks of all life, we don't know how CRISPR will affect genetically modified crops. Plants can readily disperse their genes into their surroundings via pollen and seeds; we can't be sure as to how CRISPR enhanced crops will affect unaltered plants in our ecosystem.

The important questions raised by the ethics of genome editing may result in policies and control measures that govern how CRISPR works in the future, helping avert ulterior motives and bring it to the mass populace.