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LETTER TO THE EDITOR

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Artificial Intelligence-Enhanced Application of CRISPR-Cas13a for Cancer Gene Therapy: A Breakthrough Concept

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INTRODUCTION

The invention of the clustered regularly interspaced short palindromic repeat (CRISPR) and CRISPR-associated protein (CRISPR-Cas) technologies have been a revolutionary molecular instrument that allows for exquisite gene manipulation and radically transformed the field of molecular biology. Additionally, these technologies have provided prospective precisive therapeutic implications for various clinical demands, including non-infectious diseases such as cancer as well as infectious diseases such as COVID-19. Another intriguing research area involves how this technology has integrated with other forms of technological innovation, such as artificial intelligence (AI). Therefore, this letter seeks to address the application of CRISPR, more specifically CRISPR-Cas13a (a ribonucleic acid/RNA editing technology), and its combination with AI for cancer gene therapy.

The possible role of CRISPR in cancer gene therapy

Gene therapy is a significant medical advancement, particularly with regard to cancer treatment. Nevertheless, being able to effectively deliver an intended therapy to the targeted cell has proven difficult, despite the abundance of gene modification techniques available such as gene silencing, antisense treatment, ribonucleic acid interference (RNAi), and gene editing (1).

With its ability to target RNA, CRISPR-Cas13a has excellent potential for cancer gene therapy. CRISPR-Cas13a disrupts gene expression in cancer cells while causing minor damage to healthy tissue by targeting the specific RNA sequences associated with the malignancy. CRISPR-Cas13a is a remarkable substitute for Cas9, which directly targets DNA. This process creates new opportunities for precise and controlled genetic expression. With its RNA-centric applications, CRISPR-Cas13a reduces off-target effects and improves specificity compared to RNAi systems, with a knockdown efficiency of over 90% (3). Meanwhile, the well-known CRISPR-Cas9 may also be responsible for off-target DNA editing and irreversible genomic changes; therefore, CRISPR-Cas13a provides a safer way to modify genes (2).

According to one study, the novel Cas13a expression vector that uses the decoy minimal promoter-Cas13a-U6-guide RNA (DMP-Cas13a-U6-gRNA [DCUg]) was able to reduce the expression of endogenous oncogenes efficiently and specifically at both the mRNA and protein levels while also suppressing the expression of reporter genes in the human hepatoma cells; 293T and HepG2. This additionally resulted in a reduced growth and increased apoptosis of hepatoma cells with no impact on the normal hepatocytes (4).

CRISPR-Cas13a and AI for Cancer Gene Therapy

Genome editing has been revolutionized by combining AI with CRISPR-Cas13a. AI is essential for maximizing the

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precision and efficiency of genome editing due to its capacity for analyzing enormous datasets and spotting intricate patterns, primarily in cancer gene therapy. AI algorithms collaborate to discover the best sites for CRISPR-Cas13a by examining genomic data and locating specific RNA sequences linked to the targeted genetic abnormalities, thus enabling researchers to anticipate and evaluate the effects of CRISPR-Cas13a treatments beforehand. Researchers can make well-informed decisions regarding the specificity of genetic modifications as a result of these predictive capabilities.

Promising Results and Challenges

Researchers have shown disrupting cancer-related RNA sequences with CRISPR-Cas13a in conjunction with AI to effectively prevent the growth of tumors in preclinical models. Using this molecular scalpel, researchers are able to examine genetic abnormalities linked to cancer. Delivering the RNA to the intended cells, reducing off-target effects, and handling ethical issues in human trials are among the hurdles that still need to be overcome. Off-target effects are reduced by Cas13a's accuracy and AI's predictive power but are still a cause for concern. Furthermore, incorporating AI requires a large amount of data to function (such as the whole transcriptome), and this is also a challenge that must be resolved before being fully incorporated with CRISPR-Cas13a.

Conclusion

The promise of AI and CRISPR-Cas13a in cancer gene therapy is a harmony of development and hope. With the use of AI and CRISPR-Cas13a's molecular precision alongside AI's computational power, cancer treatments may be administered with unprecedented precision and adaptability in the future.

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