

**Hudson Harris**

**Unlocking the Potential of CRISPR-Cas9 for Cystic Fibrosis: A Detailed Review**

CRISPR-Cas9 technology has revolutionized genetic engineering, offering precise and efficient genome editing capabilities. This review explores the application of CRISPR-Cas9 for cystic fibrosis (CF), particularly targeting mutations in the CFTR (cystic fibrosis transmembrane conductance regulator) gene. CF, a genetic disorder characterized by defective ion transport leading to thick mucus accumulation, is often caused by mutations like  $\Delta F508$  in the CFTR gene. The review covers the historical development of CRISPR-Cas9, its mechanism, and its transformative role in genetic engineering and medicine. A detailed examination of CRISPR-Cas9's application in CFTR gene correction highlights both the potential for therapeutic interventions and the challenges, such as off-target effects, delivery efficiency, and ethical considerations. The review underscores the importance of developing effective delivery methods and emphasizes the need for personalized approaches to gene editing. It also addresses the ethical and regulatory frameworks necessary to guide the responsible use of CRISPR-Cas9 in clinical settings. Future directions include optimizing delivery systems, enhancing editing precision, and expanding personalized medicine approaches.