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CRISPR-CAS9 GENOME EDITING IN ZEBRAFISH FOR MODELING HUMAN DISEASES: A NARRATIVE REVIEW

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Abstract:

Genome editing technologies have come a long way in terms of modern biological research by now allowing precise modification of genetic material. Various tools are under review, among which, CRISPR-Cas9 has emerged as one of the most efficient and widely used systems. This is due to its simplicity, The zebrafish, Danio rerio, has become a prominent vertebrate model for genetic studies because of its rapid embryonic development, optical transparency, and strong genetic similarity to humans. In recent years, CRISPR-Cas9 has been extensively applied in zebrafish to investigate gene function, generate targeted mutations, and establish models of human disease. This review summarizes the fundamental principles of CRISPR-Cas9–mediated genome editing and discusses its application in zebrafish research. Particular emphasis is placed on experimental workflows, including guide RNA design, embryo microinjection, and mutant screening strategies. In addition, the review highlights major research applications such as functional genomics, disease modeling, and drug discovery. Despite its numerous advantages, certain technical challenges, including off-target effects and mosaic mutations, remain important considerations. Continued improvements in genome editing strategies are expected to further enhance the utility of zebrafish as a model system for biomedical research. Overall, the integration of CRISPR-Cas9 technology with zebrafish biology provides a powerful platform for understanding gene function and advancing studies related to human health and disease.

Keywords: CRISPR; CRISPR-Cas9; genome; zebrafish; modification; genome editing.

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