Traditional genome modulation technologies.

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Description

Genome modulation technologies have revolutionized the field of genetics and molecular biology. The ability to modify genes has provided researchers with the tools to study gene function, identify disease-causing mutations, and develop new therapeutic approaches. Genome modulation technologies have become essential tools in modern genetics research, allowing scientists to modify the DNA sequence of an organism or cell. These technologies are important for understanding gene function and disease mechanisms, as well as for developing novel therapeutics. In this manuscript, we provide an overview of the traditional genome modulation technologies, including gene targeting, RNAi, and Transcription Activator-Like Effector Nucleases (TALENs). The development of genome editing techniques has made it possible to directly target and alter the genomic sequences in practically all eukaryotic cells. These techniques are based on bacterial or manufactured nucleases. By encouraging the development of more precise cellular and animal models of pathological processes, genome editing has increased our ability to understand how genetics contributes to disease. It has also started to show extraordinary potential in a variety of fields, from basic research to applied biotechnology and biomedical research.

Gene Targeting

Gene targeting involves the modification of a specific gene sequence, typically by introducing a mutation or replacing the gene with an altered version. This can be achieved through homologous recombination, where a targeting construct is introduced into the cell or organism, leading to the integration of the desired mutation or replacement into the genome. Gene targeting has been used to study gene function, develop animal models of disease, and create genetically modified crops [1-3].

RNA Interference

RNAi involves the use of small RNA molecules to silence gene expression. These small RNAs, typically 21-23 nucleotides in length, bind to complementary messenger RNA (mRNA) molecules, leading to their degradation or inhibition of translation. RNAi has become a widely used technique for studying gene function and has potential therapeutic applications in diseases caused by overactive or abnormal gene expression [4-6].

TALENs

TALENs are engineered proteins that can be designed to bind to specific DNA sequences and induce double-strand breaks. These breaks can then be repaired by the cell's DNA repair machinery, leading to the insertion, deletion, or replacement of nucleotides. TALENs have been used to create animal models of disease, engineer crops with desirable traits, and develop new gene therapies [7,8].

Applications of Traditional Genome Modulation Technologies

Traditional genome modulation technologies have been used extensively in a wide range of applications. For example, gene targeting has been used to create animal models of human disease, such as knockout mice, that allow researchers to study the function of specific genes. RNAi has been used to study gene function and identify potential drug targets for diseases such as cancer. TALENs have been used to create genetically modified crops with desirable traits such as increased yield or disease resistance [9,10].

Traditional genome modulation technologies have revolutionized the field of genetics and molecular biology, providing researchers with the tools to study gene function, identify disease-causing mutations, and develop new therapeutic approaches. The technologies reviewed in this manuscript, including gene targeting, RNAi, and TALENs, have a wide range of applications and continue to be improved and adapted for new uses. As new technologies emerge, it is important to continue to evaluate their safety, efficacy, and ethical implications to ensure that they are used in a responsible and effective manner [11].

References

1. Moshous D, Callebaut I, Chasseval R, et al. Artemis, a novel DNA double-strand break repair/V(D)J recombination protein, is mutated in human severe combined immune deficiency. Cell 2001; 105: 177-86.
2. Gao Y, Ferguson DO, Xie W, et al. Interplay of p53 and DNA-repair protein XRCC4 in tumorigenesis, genomic stability and development. Nature 2000; 404(6780): 897-900.
3. Song J, Yang D, Xu J, et al. RS-1 enhances CRISPR/Cas9- and TALEN-mediated knock-in efficiency. Nat Commun 2016; 7: 10548.
4. Chu VT, Weber T, Weferse B, et al. Increasing the efficiency of homology-directed repair for CRISPR-Cas9-induced precise gene editing in mammalian cells. Nat Biotechnol 2015; 33(5): 543-48.
5. Maruyama T, Dougan SK, Truttmann MC, et al. Increasing the efficiency of precise genome editing with CRISPR-Cas9

by inhibition of nonhomologous end joining. Nat. Biotechnol. 2015; 33: 538-42.

6. Chapman JR, Taylor MR, Boulton SJ. Playing the end game: DNA double-strand break repair pathway choice. Mol Cell 2012; 47(4): 497-510.
7. Shrivastav M, Haro LP, Nickoloff JA. Regulation of DNA double-strand break repair pathway choice. Cell Res 2008; 18(1): 134-47.
8. Dong L, Guan X, Li N, et al. An anti-CRISPR protein disables type V Cas12a by acetylation. Nat Struct Mol Biol 2019; 26(4): 308-14.
9. Suresh B, Ramakrishna S, Kim H. Cell-penetrating peptide-mediated delivery of Cas9 protein and guide RNA for genome editing. Methods Mol Biol 2017; 1507: 81-94.
10. Slaymaker IM, Gao L, Zetsche B, et al. Rationally engineered Cas9 nucleases with improved specificity. Science 2015; 351(6268): 84-8.
11. Kiani S, Beal J, Ebrahimkhani MR, et al. CRISPR transcriptional repression devices and layered circuits in mammalian cells. Nat Methods 2014; 11(7): 723-6.

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