Gene Editing Journal

Alternative Therapy to Antibiotics: CRISPR-Cas antimicrobials

Alternative Therapy to Antibiotics: CRISPR-Cas antimicrobials

DOI: http://dx.doi.org/10.29228/genediting.41450

CIHAN TASTAN,Aysegul Ates, Cihan Tastan, Safak Ermertcan

Özet

Antibiotics affect specific mechanisms of bacteria by targeting cellular pathways or functions such as inhibition of cell wall synthesis, cell membrane function, protein synthesis or nucleic acid synthesis. They can't selectively kill targeted pathogens in the mixed microbial population with these mechanisms. Antibiotics cause dysfunction not only of the bacteria that cause infection but also of the beneficial microbiota members in the host. Currently, there is no specific antibiotic strategy targeting only virulent or antibiotic-resistant bacteria. Current antibiotic strategies aren't specific; resistant bacteria allow the spread of resistance genes in the bacterial population. Recently, new molecular techniques to deal with antimicrobial resistance have been introduced. With the development of genetic engineering technologies, new antimicrobial products can be produced that specifically target virulent or antibiotic-resistant bacteria. The most important of these is the CRISPR-Cas mechanism, which is defined as the adaptive immune system of bacteria. CRISPR-based antimicrobials could be our newest defense against bacteria. Researchers could knock out plasmid-mediated antibiotic resistance genes, preventing the spread of resistance. This review will discuss antibiotic resistance, CRISPR-Cas9 and its applications against bacteria itself, which will be an important method to prevent the clonal spread of resistant strains, providing a unique solution to the global problem.

Anahtar Kelimeler

Antibiotic Resistance, CRISPR, Bacteria

Abstract

Antibiotics affect specific mechanisms of bacteria by targeting cellular pathways or functions such as inhibition of cell wall synthesis, cell membrane function, protein synthesis or nucleic acid synthesis. They can't selectively kill targeted pathogens in the mixed microbial population with these mechanisms. Antibiotics cause dysfunction not only of the bacteria that cause infection but also of the beneficial microbiota members in the host. Currently, there is no specific antibiotic strategy targeting only virulent or antibiotic-resistant bacteria. Current antibiotic strategies aren't specific; resistant bacteria allow the spread of resistance genes in the bacterial population. Recently, new molecular techniques to deal with antimicrobial resistance have been introduced. With the development of genetic engineering technologies, new antimicrobial products can be produced that specifically target virulent or antibiotic-resistant bacteria. The most important of these is the CRISPR-Cas mechanism, which is defined as the adaptive immune system of bacteria. CRISPR-based antimicrobials could be our newest defense against bacteria. Researchers could knock out plasmid-mediated antibiotic resistance genes, preventing the spread of resistance. This review will discuss antibiotic resistance, CRISPR-Cas9 and its applications against bacteria itself, which will be an important method to prevent the clonal spread of resistant strains, providing a unique solution to the global problem.

Keywords

Antibiotic Resistance, CRISPR, Bacteria

References

Adedeji, W. A. (2016). THE TREASURE CALLED

Adedeji, W. A. (2016). THE TREASURE CALLEDANTIBIOTICS. Annals of Ibadan postgraduate medicine, 14(2), 56–57.

Adli, M. (2018). The CRISPR tool kit for genome editing andbeyond. Nature communications, 9(1), 1911. doi:10.1038/s41467- 018-04252-2

Allen, H. K., Moe, L,, A, Rodbumrer, J., Gaarder, A.,Handelsman, J. (2009). Functional metagenomics reveals diversebeta-lactamases in a remote Alaskan soil. ISME J, 3(2):243–251. doi:10.1038/ismej.2008.86

Aminov, R. I. (2009). The role of antibiotics and antibioticresistance in nature. Environ. Microbiol, 11, 2970– 2988. doi:10.1111/j.1462-2920.2009.01972.x