Genes for the Biosynthesis of Plantazolicin, a Molecule Effective in Killing Bacillus Anthracis

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Technology description

This technology describes a set of genes that generates the novel microcin, Plantazolicin that is specific for B. anthracis, which causes anthrax.

Anthrax disease, caused the by the bacterium Bacillus anthracis, is a major bioterrorism threat. Currently, B. anthracis infections are treated with various broad-spectrum antibiotics. Antibiotic treatment must be effective at eliminating all B. anthracis, which often requires over 60 days of antibiotic treatment. Consequently, the current method of treatment increases the dangers of multi-drug resistance. Multi-drug resistance arises from horizontal gene transfer of drug-resistant bacteria and has lead to the generation of many harmful infectious diseases including, but not limited to, Vancomycin-resistant enterococcus (VRE) and Methicillin-resistance Staphlococcus aureus (MRSA). Most current treatments of bacterial infections kill off the human intestinal bacterial which has two negative side effects: the "healthy" bacteria serve as a reservoir for antibiotic resistance and keep other pathogens at bay. Prolonged, broad-spectrum antibiotics leave patients at risk for secondary infections that are harder to treat that the primary infection. Therefore, it would be beneficial to develop a treatment for Anthrax that would avoid these potent side effects.

Microcins are antibacterial peptides that differ from popular broad-range antibiotics in a variety of ways. One important difference is that microcins target a narrow spectrum of bacteria. As a result, natural human microbial flora will go undisturbed aiding in decreased side effects. A second important difference is that microcins are less likely to be horizontally transferred due to their narrow target spectrum and complex machinery required for synthesis and export, which is often encoded on multiple genes.

This technology describes a set of genes that generates the novel microcin, Plantazolicin that is specific for B. anthracis, which causes anthrax. A gene cluster encoding the synthesis, modification, immunity and export machinery of the thiazole/oxazole-modified microcin, Plantazolicin, was identified from Bacillus amyloliquefaciens FZB42. The microcin producing strain was modified to increase expression of Plantazolicin by 5-fold compared to wild-type.

The unique antimicrobial peptide Plantazolicin can kill B. anthracis. It is produced by a culturable bacterium, which contains a gene cluster containing all enzymes necessary for synthesis and export.

Advantages

Easily produced in the lab and in large quantities
Specific against B. anthracis, the human pathogen responsible for Anthrax
Specificity minimizes side-effects cause by disruption of symbiotic microbial flora
Specificity reduces the threat for development of multi-drug resistance

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