Enzymes and Genetic Constructs That Enable Genetic Engineering of Many Bacterial Species Considered Difficult to Engineer

Published date: July 12, 2019

Technology description

Enables Scientists to Produce Plasmid, or Other Genetic Mobile Element, DNA That Is Resistant to Degradation by Bacterial Restriction Enzymes

These tools being developed by UF’s scientists produce modifications to plasmid or phage DNA that make the plasmid or phage resistant to a wide range of endonucleases. The common processes used to modify bacteria through insertion or propagation of foreign DNA into a bacterial cell has been successful only in a small number of bacterial species. This is because the natural defense mechanisms of a large variety of bacterial species prevents successful genetic modification, limiting the application of powerful genetic tools such as CRISPR-Cas9 to a handful of laboratory species. These new tools can be used to make modifications to the “foreign” plasmid or phage DNA to enable evasion of bacterial restriction defense mechanisms. This in turn will increase the efficiency of transformation of foreign DNA into a wide variety of bacterial cells thereby, allowing for genetic manipulation of a larger number of bacterial species/strains, as well as facilitating phage infection.
Researchers at the University of Florida are developing a modification technique that protects inserted foreign DNA from bacterial defense. Modifying DNA with 7-deazaguanine derivatives increases its resistance to the host bacterium’s restriction enzymes, reducing the susceptibility of phage or plasmid DNA to degradation upon introduction into the target bacteria.

Technology

Bacterial restriction enzymes cleave foreign DNA, preventing it from successfully settling in the bacterium’s genetic information during insertion procedures. The only bacterial species that are compatible with foreign DNA insertion are strains that naturally avoid degradation and laboratory bacterial models. Plasmid DNA partially or fully resists restriction enzymes if it incorporates 7-deazapurine derivatives such as preQ0, preQ1, and archaeosine. This modification increases the uptake efficiency of the plasmid into the host by limiting the prime degradation by the restriction systems, allowing the plasmid to adapt to the natural modification system of the host, therefor leading to more successful bacterial transformations. The same goes for phages: a phage that does not naturally

produce the modification propagated on a bacterium producing the modification will have its DNA modified, and can be used on another host difficult to infect.

Application area

DNA modification that improves bacterial transformation efficiency and expands the range of bacteria species compatible with gene therapy. Modified phages that improve their infection rate, either to kill pathogens with phage therapy or to be used as DNA delivery systems.

Advantages

Prevents modified DNA degradation, allowing for the genetic manipulation of more species of bacteria. Increases genetic engineering efficiency, reducing the time and cost of research into any process that required the use of non-model bacteria or phage.

Institution

University of Florida

Inventors

Geoffrey Hutinet
Postdoctoral Associate
MICROBIOLOGY / CELL SCI
Valerie De Crecy
Professor
MICROBIOLOGY / CELL SCI

联系我们

叶先生

电 话：021-65679356

手 机：13414935137

邮 箱：yeyingsheng@zf-ym.com