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Plasmid-Free Systems for Genome Engineering in Polyploid Organisms

DNA modifying enzymes are common tools for genome engineering. Genes encoding these enzymes are typically delivered into a host via plasmids and later removed by various counter-selection methods. However, this process involves steps or genetic parts that aren't available or compatible with certain organisms. For many polyploid organisms, such as plants, algae and cyanobacteria, for example, the plasmid and counter-selection systems typically employed with existing genome modifying tools are simply not available.

Researchers at Arizona State University have developed a novel, plasmid-free strategy for genome engineering in polyploid organisms. By this approach, transient integration and expression of genes encoding DNA modifying enzymes is possible with easy and efficient removal of the genes after the editing events have occurred. This technology eliminates the need for replicative plasmids and conventional counter-selection methods, while also eliminating the persistence of undesirable genetic artifacts associated with conventional genome engineering techniques.

This technology represents a new platform for the transient integration and expression of DNA modifying genes in polyploid organisms that is versatile, cost effective and efficient.

Potential Applications

- Efficient genome editing in polyploid organisms (plants, algae, cyanobacteria, etc.)

o Carbon-neutral & bio-based applications, including production of: biofuels, biopolymers, pharmaceuticals, fine chemicals, lubricants, human/animal supplements, fragrances, cosmetics, surfactants, solvents and more

o Protein production, including for: therapeutics, vaccines, and more

Benefits and Advantages

- Plasmid-free system

- Universally compatible counter-selection strategy
- Successfully tested in cyanobacterium Synechococcus sp.
- Easily and rapidly reversible

o DNA modifying genes easily and efficiently removed from the host when desired

- Cost effective and reduces time for genome modifications in polyploidy organisms
- Undesirable genetic artifacts, commonly seen with conventional genome engineering methods, are eliminated

For more information about this opportunity, please see

Jones et al - Workshop Abstract (page 73) - 2019

For more information about the inventor(s) and their research, please see

Dr. Nielsen's laboratory webpage