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Novel Vectors which Spread from Cell-to-Cell in Plants

Plants are a promising platform for rapid production of biologics as they offer many advantages over traditional systems, including safety, speed, versatility and cost. Geminiviruses are a group of small plant viruses that have been studied and used extensively in such plant-based production systems. Because geminiviruses replicate in nuclei, their DNA has to cross two barriers for systemic spread (and subsequently production of gene products/biologics), thus efficient cell-to-cell movement is critical. Exchange of genetic components among different geminiviruses has the potential to alter systemic movement as well as the host range or tissue specificity of a virus.

Researchers at the Biodesign Institute of Arizona State University have developed novel geminiviral expression systems that have been modified to optimize the relative expression levels of a begomovirus movement protein (MP) and nuclear shuttle protein (NSP) to enhance cell-to-cell movement. Several vectors have been constructed with a combination of different terminators, promoters, intergenic regions, mutated genes and specific arrangement of the genes which result in increased accumulation of gene product. These chimeric vectors could help in high level production of a biologics, even in substantially reduced concentrations of agrobacterium. Further, they allow sufficient replicon availability in the nucleus for viral transcription while avoiding triggering the plant hypersensitive response or excessive leaf cell death.

These novel chimeric vectors enhance cell-to-cell movement while reducing the amount of agrobacterium needed and increase expression of biologics without significant detrimental effects to the plants.

Potential Applications

- Plant-based production of biologics (proteins, vaccines, enzymes & other biomolecules)
- Research on plant-based biological production systems

Benefits and Advantages

- The vectors allow spread from cell-to-cell in plants
 - o Reduces the need for high agrobacterium concentrations
 - o Could increase host range or tissue specificity of the virus
- Improved expression of recombinant proteins in plants even when the agrobacterium concentration was reduced by a factor of 10
- The hypersensitive response or excess leaf cell death is reduced or minimized
- Does not adversely impact replication and gene expression from viral replicons
- Allows cell-to-cell movement comparable to or exceeding the movement efficiency of wild-type begomovirus replicons

For more information about this opportunity, please see

[Diamos et al - J Gen Virol - 2019](#)

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

[Dr. Mason's departmental webpage](#)