eccDNA Replicon for Improvement in DNA Delivery and Targeting

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eccDNA Replicons express genes and biochemical pathways outside of the chromosomes

Market Overview

Extra-chromosomal circular DNA (eccDNA) replicons deliver and express foreign DNA, which may include gene therapy targets and DNA editing reagents, outside of the main chromatin body. EccDNA are a vehicle for ultra-high gene expression. Gene therapy technologies such as CRISPR/Cas9 are projected to grow beyond $50 billion by 2023. Similarly, the agrobiotechnological industry spends approximately $40 million registering each biotechnological trait used in crops. With nearly 500 agrobiotechnological traits registered globally, eccDNA may provide an attractive means to circumvent these regulations. It may also provide a route to develop improvements in current human gene therapy technologies as eccDNA technology is developed in mammalian systems.

Technical Summary

The eccDNA plant replicon can be utilized as a vehicle for transferring and enhancing beneficial traits in crops. The extra nuclear replicon is a highly dynamic unit that evolved naturally in Palmer amaranth as an adaptive survival mechanism to rapidly increase gene copy number of the EPSPS gene in response to the herbicide glyphosate. Over expression of this gene Palmer amaranth, confers resistance to glyphosate. The invention allows for the over expression of a target genes and biochemical pathways as desired, especially where gene dosage enhances a desired trait. EPSPS may be maintained in the replicon to use glyphosate as a selectable marker for plant biotechnology. This invention solves, the problem of transgene recalcitrance. Knowledge of this plant replicon can be used to tailor species-specific replicons, and also opens the door to transgene stacking and exploiting precision trait enhancement, with effects that may be analogous to heterosis. Such a system could be described as analogous and complimentary to the Crispr-CAS9 gene editing system.

Application

Gene therapy, agrobiotechnology

Development Stage

Prototype

Advantages

- eccDNA replicons avoid regulatory challenges for registration of genetically modified organisms
- Are not limited to foreign DNA cargo size
- Serve as a vehicle for gene copy amplification and ultra-high gene expression

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Utility	United States Canada	NA	2020/21318 3132492	2017-026	Dr. Christopher A Saski William T Molin

About the Inventors

Dr. Christopher Saski

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Dr. Saski is a Systems Geneticist and Translational Scientist whose expertise spans various disciplines including genomics, quantitative genetics, bioinformatics, computational and functional biology. His research focuses on unraveling the connections between genome structure and function in agriculturally important crop and weed species. This work aims to contribute to the production of healthier foods, the advancement of sustainable agriculture, and the development of environmental systems that sustain agriculture. Dr. Saski is recognized as an authority in the analysis and translation of high-dimensional genomic datasets, the dissection of the genetic underpinnings of traits, and the application of this knowledge to enhance crop and agricultural practices.

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