CELL PENETRATING PEPTIDES FOR NUCLEIC ACID AND PROTEIN DELIVERY IN PLANTS

Tech ID: 33191 / UC Case 2023-147-0

PATENT STATUS

Patent Pending

BRIEF DESCRIPTION

Researchers at UC Berkeley have developed methods to deliver biomolecules to plant cells using new plant-derived cell penetrating peptides (CPPs).

Despite the revolution in DNA editing that the last decade has brought, plant genetic engineering has not been able to benefit to the same extent. This is due to certain challenges in plant physiology that limit the delivery of exogenous protein cargos, as required in the CRISPR-Cas9 system, primarily due to the plant cell wall. In mammalian cells, for instance, cargo delivery can be accomplished using cell-penetrating peptides (CPPs) which are short peptides that facilitate the transport of cargo molecules through the plasma membrane to the cytosol. While this technology has been optimized in mammalian cells, few have studied the delivery of CPPs in plants to verify whether the cell wall is permissible to these materials. Another barrier to the use of nanotechnologies for plant biomolecule delivery is the lack of quantitative validation of successful intracellular protein delivery. The near universal dependence on confocal microscopy to validate delivery of fluorescent proxy cargoes can be inappropriate for use in plants due to various physiological plant properties, for example intrinsic autofluorescence of plant tissues. Therefore, there exists an unmet need for new materials and methods to deliver biomolecules to plant cells and to confirm the delivery of proteins of varying sizes into walled plant tissues.

Stage of Research

The inventors have developed methods to deliver proteins into plant cells using cell penetrating peptides which are appropriate for use with CRISPR-Cas9 technology, siRNAs, zinc-finger nucleases, TALENs, and other DNA editing methods. They have also developed a biomolecule fluorophore-based assay to accurately quantitate protein delivery to plants cells.

Stage of Development

Research - in vitro

SUGGESTED USES

- Localizing CPP-protein fusion constructs to the nucleus or cytoplasm of plant cells.
- Using confocal microscopy to confirm delivery of proteins through the full thickness of leaf tissue.
- Use of the CPP-protein fusion constructs as a screening platform.

ADVANTAGES

- Increased plant cell penetrating capabilities as compared to previous technologies.
- The CPP constructs can enter plant cells through diffusion, without the use of biolistic force.
- There are hundreds of thousands of plant homeodomain proteins across various plant species that could exhibit cell penetrating activities, therefore the present disclosure could present a broad class of sequences for which cell penetrating capabilities are exhibited.

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Plant, Cell wall, delivery method, cell penetrating peptides, protein delivery

CATEGORIZED AS

- **Agriculture & Animal Science**
  - Plant Traits
  - Plant Varieties
- **Biotechnology**
  - Food
  - Genomics
  - Proteomics
- **Engineering**
  - Engineering

RELATED CASES

2023-147-0

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Gene Delivery Into Mature Plants Using Carbon Nanotubes
- Method For Imaging Neurotransmitters In Vitro and In Vivo Using Functionalized Carbon Nanotubes

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