IMPERIAL
ENTERPRISE

Novel integrase-based system for enabling nitrogen fixation in non-fixing yet agriculturally relevant bacterial chassis

A direct, precise and reliable method for seamlessly integrating large nitrogen fixation clusters into virtually any bacterial strain – unlocking exciting new frontiers in biofertilizer engineering.

Proposed Use

Originally designed to overcome key technical barriers in engineering plant-associated bacteria for nitrogen fixation, this innovation offers a rapid, user-friendly method to transfer nitrogen-fixing capabilities into virtually any soil-dwelling bacteria. By enabling this, it paves the way for a new generation of high-performing N biofertilisers with enhanced effectiveness in the field.

Problem Addressed

Biofertilisers — specifically, engineered nitrogen-fixing bacteria —offer a sustainable alternative to chemical fertilisers, enhancing crop productivity while reducing environmental and health concerns. However, integrating nitrogen fixation capabilities into agriculturally relevant strains is highly challenging, as it requires incorporating large, complex gene clusters into bacterial genomes. Existing methods are cumbersome, inefficient, and lack broad applicability, creating a significant bottleneck in the development of effective biofertilisers for sustainable agriculture.

Technology overview

This invention enables the direct, precise, and stable integration of nitrogen fixation clusters into a wide range of agriculturally important bacterial strains. By leveraging a novel integrase-based system, it ensures consistent performance across diverse host strains, eliminates the need for labour-intensive screening, and minimises metabolic disruptions—making bacterial engineering for nitrogen fixation seamless and efficient.

Inventor information

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Highlights

- Radically simplifies the integration of large *nif* clusters into non-fixing, agriculturally relevant strains
- Works across diverse bacterial hosts without extensive modification
- Already been successfully used to engineer nitrogen fixation capabilities into multiple non-fixing strains
- Led to the development of agriculturally relevant strains with substantial ammonia secretion capabilities

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