

Synthetic Carbon Fixation Pathways For Superior Biomass Generation

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Overview

Prof. Ron Milo and his team have developed alternative synthetic carbon fixation pathways that have the potential to significantly enhance carbon fixation rates in plants. By leveraging a systems biology approach, they identified novel pathways that are predicted to be two to three times faster than the natural Calvin-Benson cycle, which could lead to increased crop yields and biomass production without expanding arable land use.

Applications

- **Enhanced Crop Yields:** Boosts plant growth and productivity by improving carbon fixation efficiency, allowing for higher yields on the same amount of land.
- **Biofuel Production:** Provides a more cost-effective feedstock for biofuel production due to increased biomass generation.
- **Sustainable Agriculture:** Reduces the need for additional resources such as water and fertilizers, contributing to more sustainable farming practices.

Advantages

- **Higher Carbon Fixation Rates:** Predicted to be two to three times faster than natural pathways, enabling superior biomass production.
- **Improved Kinetics:** Employs more efficient enzymes like phosphoenolpyruvate carboxylase, minimizing kinetic bottlenecks.
- **Thermodynamic Efficiency:** Designed to minimize thermodynamic limitations, offering a robust alternative to natural carbon fixation cycles.

Stage of Development

The team has computationally identified these synthetic pathways by comparing them against natural pathways in terms of kinetics, energetics, and topology. The initial findings demonstrate significant quantitative advantages, making these pathways promising candidates for future synthetic biology applications in crops and bioengineered organisms.



References

Bar-Even A, Noor E, Lewis NE, Milo R. Design and analysis of synthetic carbon fixation pathways. *Proc Natl Acad Sci*. 2010;107(19):8889-8894. [doi:10.1073/pnas.0907176107](https://doi.org/10.1073/pnas.0907176107) [1]

Patent Status

USA Granted: 10,077,437 USA Granted: 9,410,131
