Synthetic biology is vital to the expansion of a bio-based economy

Background/Objective

The field of synthetic biology is vital to the expansion of a bio-based economy, enabling novel resource utilization, improved performance of bioproducts and more. This manuscript provides a perspective on the opportunities and needs for synthetic biology in the bio-based economy along with a review of recent advances in the field that are of particular importance.

Approach

- A comprehensive overview on feedstocks and products was used to provide context on the opportunities for synthetic biology, as well as follow up sections on other enabling technologies for realizing a bio-based economy.
- Synthetic biology advances are presented in a hierarchical manner, from the introduction of DNA, to available genetic tools and more advanced, high-throughput genetic technologies.

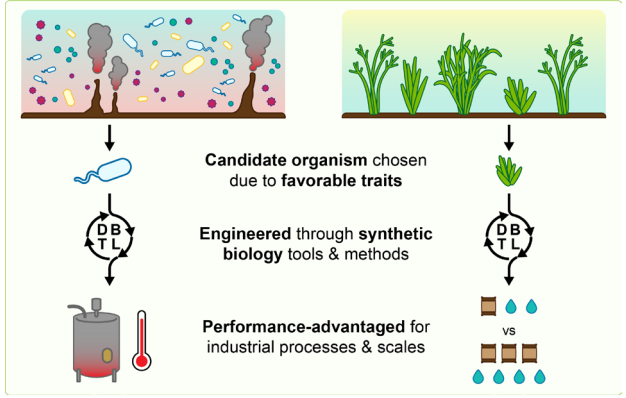
Results

- Resources that can be valorized as feedstocks through biological processes are presented, along with the resulting performance- and process-advantaged products.
- Characteristics that make organisms particularly well-suited for industrial processes are highlighted.
- Advances in microbial and plant synthetic biology to expand the bio-based economy are discussed.
- Technologies in adjacent fields that enable advances needed to expand the bio-based economy, as well as challenges that must be addressed through collaboration with stakeholders, are also presented.

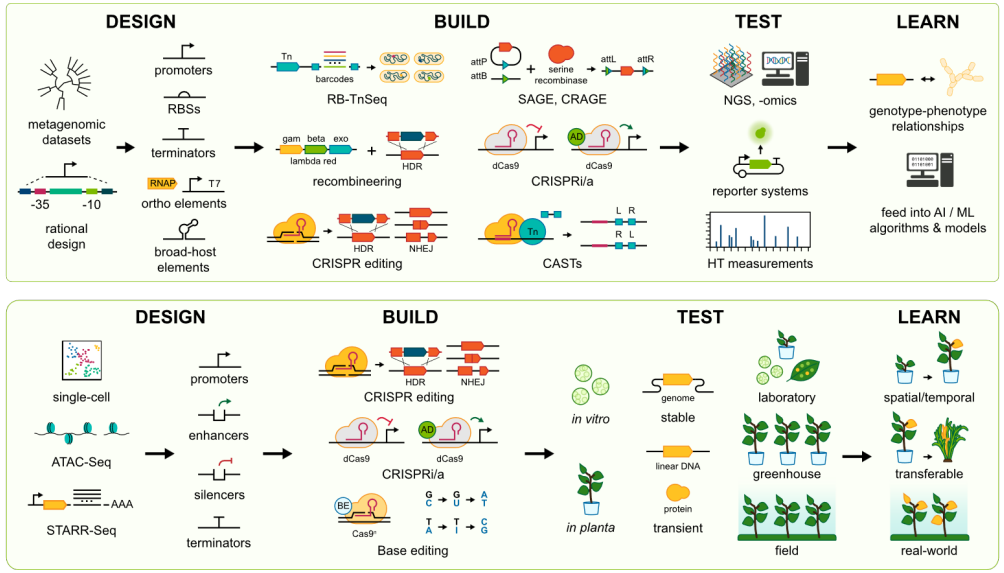
Significance/Impacts

This work provides a comprehensive overview of the field of synthetic biology within the frame of the bioeconomy. It provides context that introduces the reader to the bio-based economy and discusses how advances in synthetic biology have or will enable its expansion.

Garza Elizondo et al., *Biotechnol. Adv.* (2025). doi: 10.1016/j.biotechadv.2025.108775



Selecting organisms with favorable traits facilitates and accelerates bioengineering, and in turn, industrial deployment.



An overview of advances in synthetic biology in microbes (top) and plants (bottom).