Barriers and Solutions for Genetic Tool Development for Rapid Domestication of Non-model Microorganisms

U.S. DEPARTMENT OF ENERGY | Office of Science

Background

- Non-model microbes have useful phenotypes that could be leveraged to produce biofuels and bioproducts.
- Challenges associated with the development of genetic tools in these organisms prevents both fundamental research and widespread adoption by industry.

Approach

- Leveraging our experiences in CBI, we reviewed the literature and highlighted the most critical areas to address when developing genetic tools in new organisms.
- This review focuses on the diverse methods for enabling DNA entry into cells, evasion of host defense systems, and stable maintenance, diverse methods for deleting and inserting DNA into the chromosome, characterizing the genetic “parts” that are most critical, and development of more advanced genetic tools for rapid strain development.

Outcome

- This comprehensive review acts as a “how-to” guide for any researcher to begin developing genetic tools in their organism of choice, with a focus on the approaches that are applicable most broadly to diverse organisms.

Significance

- The ability to rapidly develop genetic tools for non-model bacteria has wide-ranging impacts not only on biotechnology, but also on fundamental and applied research in gene-function discovery, pathogenesis, drug discovery, microbial ecology, and many other areas of microbiology.

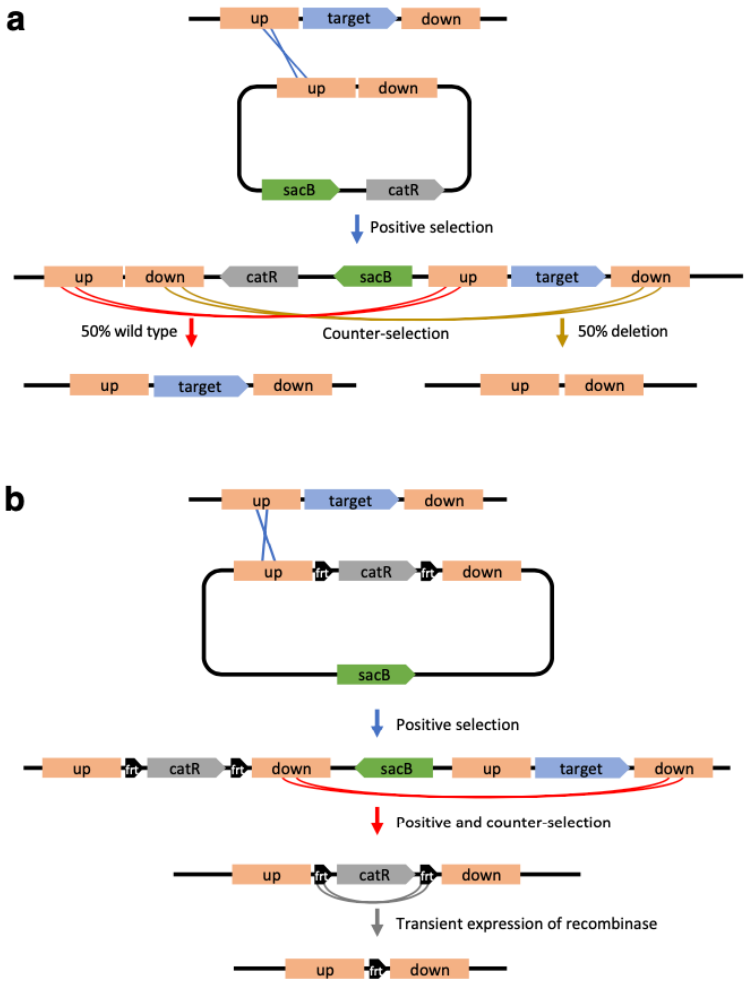

Illustration of two of the many different approaches for creating gene deletions in bacteria

Riley, LA et al. *Biotechnology for Biofuels* (2021) 14:30. https://doi.org/10.1186/s13068-020-01872-z

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