Leveraging Automated Adaptive Laboratory Evolution (ALE) to Advance Specialized Biofoundries

Background/Objective

- Microbial experimentation is labor-intensive and hard to scale in distributed labs, limiting reproducibility. Specialized biofoundries enable automated science at scale, with adaptive laboratory evolution (ALE) serving as a test case.

Approach

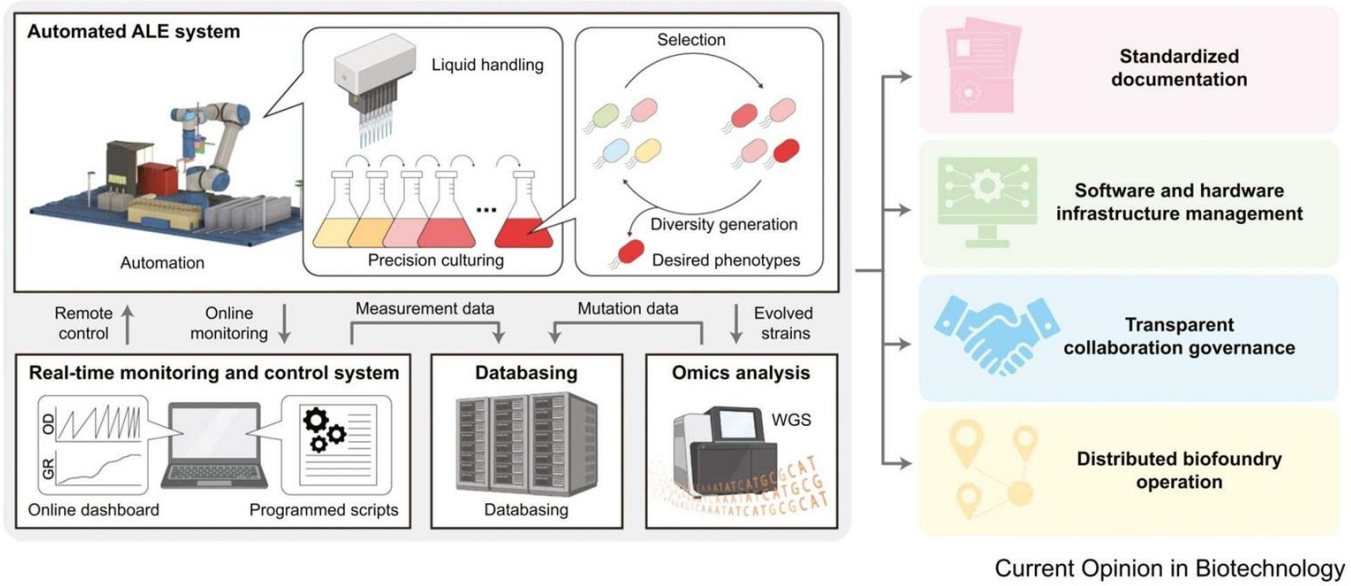
- Automated ALE formats – serial transfer, continuous culture, colony transfer, and microfluidics – are reviewed and compared.
- Design principles integrating robotics, real-time monitoring, omics analytics, and validation into a biofoundry are outlined.

Results

- Auto serial transfer emerges as an effective industrial format, offering the scalability and robustness needed to form an effective biofoundry.
- Parallelized and controllable ALE reveals convergent mutational targets, generating reusable design-ready genetic parts.

Significance/Impacts

- ALE accelerates the development of next-generation microbial technologies, reducing the time and cost required to bring new biotechnology solutions to market.



A conceptual overview of how automated platforms, real-time data integration, and standardized operational protocols transform labor-intensive evolutionary engineering into a scalable, AI-compatible discovery engine.

Feist, A. M., et.al. Current Opinion in Biotechnology. doi: 10.1016/j.copbio.2026.103496