



Introduction to Adaptive Evolution, a Powerful Strategy for Microbial Strain Improvement

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What is Adaptive Evolution (AE)?

- ❖ The process of propagating advantageous mutations through positive selection, resulting in a population more fitted to the specific living conditions
- ❖ Can be accelerated in laboratories by growing microbes under specifically designed selection conditions for a large number of generations
- ❖ A proven strategy for microbial strain improvement in industrial biotechnology

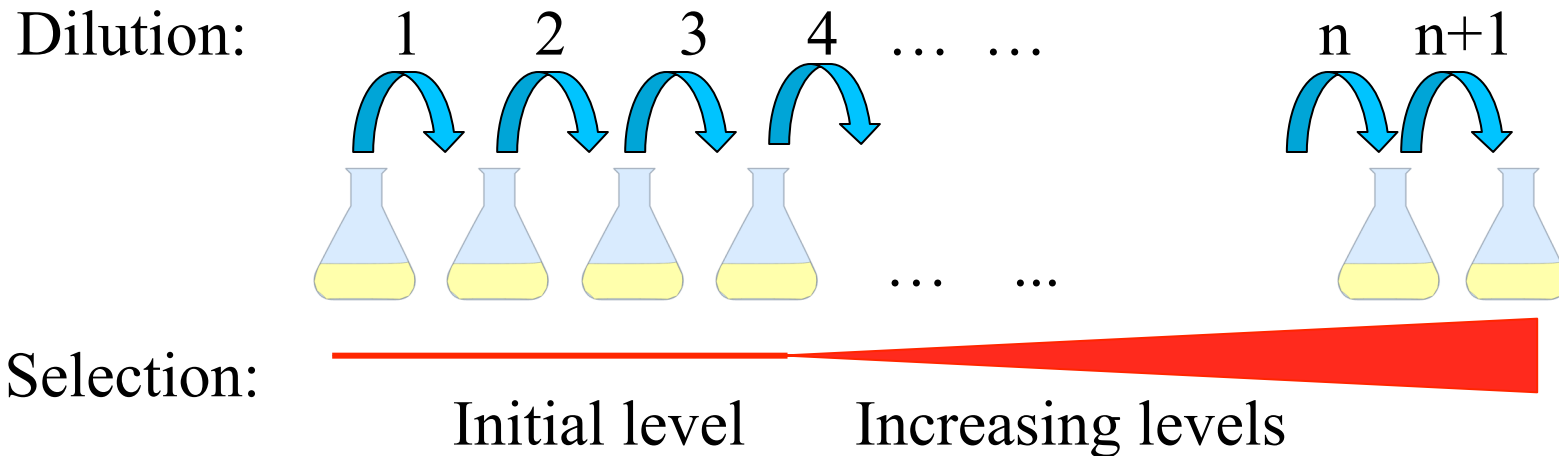
Adaptive Evolution (AE) Applications

Typically, the starting strain grows poorly under the selection conditions. Mutations arise, and cells gaining beneficial mutation(s) will grow faster and take over the population. AE has been applied to various microorganisms and to improve various traits:

- ❖ Biofuels or other organic solvents tolerance
- ❖ Thermal tolerance
- ❖ Osmotic stress tolerance
- ❖ Oxidative stress tolerance
- ❖ Alternative carbon source utilization
- ❖ Nutrient utilization efficiency
- ❖ Bioprocess product tolerance
- ❖ Improved fitness in the presence of multiple abiotic stresses

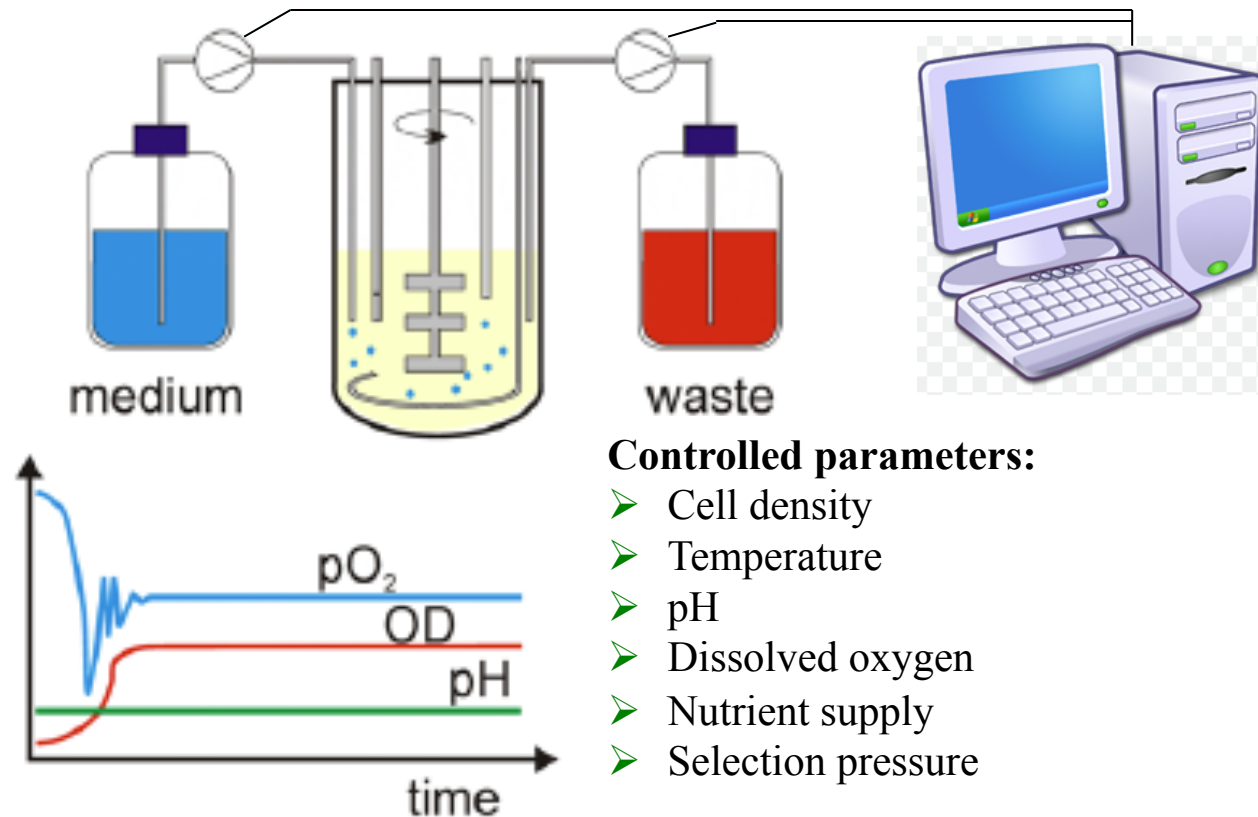


Adaptive Evolution Method: Batch Culture Serial Dilution



- ❖ Effective for certain applications
- ❖ Can accommodate running different selection schema in parallel
- ❖ Cultures can be saved at different time points for various analysis
- ❖ Shortcomings: selection conditions not well controlled (varying cell density, growth rate, nutrient supply, pH and dissolved oxygen)

Adaptive Evolution Method: Chemostat



- ❖ Computer controls and monitors many important parameters
- ❖ Much faster and more efficient than batch cultures for many applications

Adaptive Evolution (AE) for Strain Development

- ❖ No prior knowledge on genetic or metabolic pathways for a trait required to undertake AE
- ❖ AE might be the only option for improving complex trait or when genetic engineering is not applicable
- ❖ Genetic engineering could be in some cases a key for providing the necessary background for successful AE
- ❖ AE could result from loss of function, gain of novel function, increased or decreased gene dosage, altered expression of a single gene or large sets of genes...
- ❖ Next Generation Sequencing (NGS) could lead to the identification of specific mutation(s), as potential new targets for genetic engineering



Contract Research Service at Bio-Technical Resources

Bio-Technical Resources (BTR) has the capacity and proven experiences in designing and conducting Adaptive Evolution for different applications. Please contact us for further discussion for your needs and we look forward to working with you.

Adaptive Evolution Reference

- ❖ Dragosits and Mattanovich, *Microbial Cell Factories* 2013, 12:64
- ❖ Conrad et al, *Molecular Systems Biology* 2011, 7:509

