Kobe Maristela

Paper: "Dynamics of adaptation and diversification: A 10,000-generation experiment with bacterial populations"

Authors: Richard E. Lenski and Michael Travisano

Summary: [key topic in evolution] Evolution heavily relies on mutations and genetic drift to act as a catalyst for the major changes in morphology and traits of a population as seen through multitudes of generations. **[goal of the paper]** This paper aims to address whether adaptation and diversification are coupled through the rate in which identical population diverge while placed in identical environments. **[hypothesis]** The hypothesis being tested is if its chance that causes the uniqueness of evolution history, and not the environment that the organisms must adapt to survive. **[prediction/specific questions]** The authors pose the question of "the fate of genetic and phenotypic novelties" and "the repeatability of adaptation." Furthermore, the author dives in predicting if changes in morphology is due to mutation and genetic drift rather than an adaptation to the environment. **[experimental design]** The authors designed an experiment with twelve duplicate *Escherichia coli* (*E. Coli*) population propagating their growth for 1500 days (10,000 generations), while maintaining identical environments for each of the twelve *E. Coli* populations. **[experimental protocol]** The experiment required each of the twelve population to be derived from a single cell through asexual cloning, ensuring that there was no initial genetic variation between the populations. Furthermore, the environment of each population was kept identical following a daily serial transfer regime. The transfer consisted of the populations being diluted in 10 mL of "a glucose-limited minimal salts medium", while being kept at 37°C. Periodically samples were taken from each population and stored at -80°C to be analyzed later. **[key results of the study]** In completion of the experiment, the authors found that the cell size of the *E. Coli* population increased rapidly for the first 2000 generations. However, after several more generations passed, there was no significant change in evolution of cell size for the *E. Coli* population showcasing an evolutionary stasis in growth. **[support for their hypothesis?]** With the results showing an evolutionary stasis on the last several thousand generations, many factors such genetic constraints or a stabilizing selection could have resulted in this stagnation of growth. Regardless, the authors did confirm that the varying cell sizes was indeed a result of random genetic drift accepting their original hypothesis of evolutionary uniqueness due to chance. **[most important conclusion]** While the experiment proved that evolutionary change happen can happen solely with mutations and genetic drift, the fact remains that nature is ever changing and complex. Real time data cannot be mimicked without the use of a time travel to see the experiment unravel from start to finish in a real-world scenario. Overall, we can conclude that the genetic variation of a population can be correlated with just chance, without the environment playing a role in the diversification of the population.

Critique: My main critique on the paper is that while the authors kept the populations in a relatively identical environment to prevent environmental adaptation, they did not set aside control groups of a population being starved and a population that was freely nourished with glucose. By adding these control groups, the authors could now compare a resource-rich population and a resource-deprived population to the twelve experimental populations. The addition of these new groups adds to the data of how morphologies differ when the environment is a factor for evolution. Additionally, the new data can aid in answering the question of evolutionary stasis of the population in correlation with an adaptation to the environment. Furthermore, new questions could be asked such as how the resource-deprived population will adapt to the environment, how will the resource-rich population evolve when there is no limit in resources and does the introduction of a complex environment aid in preventing evolutionary stasis. Overall, countless of additional possibilities could be explored by the authors in simply adding these two new additional populations to the experiment.