Evolutionary Constraints of Defense Against T6SS Attack in E. Coli

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Abstract: The Type VI secretion system (T6SS) is a toxin-tipped molecular spear used by Gram-negative bacteria to eliminate competitors in the environment. While the structure and function of the T6SS are well understood, less is known about how targeted bacteria can defend against T6SS attack. To investigate mechanisms of T6SS defense, we experimentally evolved eight replicate populations of *Escherichia coli* under repeated attack by *Vibrio cholerae*'s T6SS. In just 30 days, evolved populations increased their T6SS survival by an average of 260-fold compared to the ancestor. However, this increase in T6SS survival came at a cost to growth rate, with evolved populations reproducing ~40% as much as the ancestor over the course of one growth cycle. When we further evolved these populations in the absence of T6SS attack, T6SS survival decreased in favor of faster growth. These results indicate that the tradeoff between growth and T6SS survival constrains the evolution of T6SS defense, as defensive mechanisms are not maintained in the absence of T6SS attack. This evolutionary constraint on T6SS defense ensures the continued efficacy of the T6SS as an antagonistic strategy.

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