Evolutionary Adaption of Escherichia Coli to Stress-Inducing Levels of Acid and NaCl

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In nature, bacteria such as *Escherichia coli* cope with numerous changes in environmental conditions; for many, the ability to evolve to these changes proves crucial towards survival. The rising numbers of urinary tract infections caused by *E. coli* paired with the increasing traces of this microbe in poultry and acidic foods have led the science community to question and note its evolutionary patterns. While many studies have been conducted to determine the effects of extreme thermal conditions on various strains of this prokaryote, data pertaining to other natural stresses is limited. This experiment explored two commanding factors that greatly influence the survival of *Escherichia coli*: susceptibility to extreme acidic levels and osmoregulation of NaCl across the cell membrane. Considering Darwin's theory of natural selection, strains of Escherichia coli were aseptically plated on LB dishes of extreme pH solutions to determine the most tolerant colonies, which were then isolated in liquid nutrient broth to culture a new generation. Once the new generation had adapted to the stressful environment, exposure to 3.5% NaCl determined if any cross-protection genes were triggered. Competition between the more resistant and initial generations determined whether trade-offs occurred. The process of isolating the colony closest to the inhibition area, culturing the sample, and plating the resulting solution would continue until the bacterial colony could withstand a pH of 1. It was discovered that the strains available were already highly tolerant of both stressful conditions, leading to the belief that there were previous exposures that did result in cross-protection.