GASP!: Growth Advantage in Stationary Phase in Acinetobacter baylyi

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As antibiotic resistance becomes an ever-greater issue, understanding of bacterial evolution is crucial. Growth advantage in stationary phase (GASP) enables rapid evolution in stress conditions. Intriguingly, competence (DNA uptake) genes are overexpressed in GASP. This study investigates the role of competence in GASP. An assay was performed to confirm the presence of a GASP phenotype in A. baylyi. Antibiotic resistance markers were transformed into wild type bacteria to differentiate strains. Cells were aged to one and seven days. Old and young cells were co-incubated in a 1:1000 ratio. Dilution series were performed immediately after inoculation, and at days 1, 4, and 7 to quantify the number of bacteria of each strain. Similar experiments were performed to determine the effect of adding DNA to cell cultures. The experiment was also performed using single-gene deletion mutants lacking key competence proteins. Controls were performed by competing same-aged cells. It was found that A. baylyi exhibits GASP. Further experiments determined that, while providing young cells with old DNA does not significantly alter GASP, providing old cells with young DNA results in a class II phenotype, indicating the presence of rapid horizontal gene transfer. Competition of single-gene deletion mutants against wild type cells yielded a variety of phenotypes, suggesting lack of competence proteins interferes with GASP. Results indicate that horizontal gene transfer is implicated in survival of stressful conditions and that stress induces rapid evolution. This understanding of GASP is an essential weapon in the race against bacterial evolution in hospitals and other critical settings.

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