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What is Growth? Concurrent determination of a bacterial population's many shades of growth GUILLAUME LAMBERT, University of Chicago, EDO KUSSELL, New York University — One of the most exciting developments in the study of the physics of microbial life is the ability to precisely monitor stochastic variations of gene expression in individual cells. A fundamental question is whether these variations improve the long-term ability of a population to adapt to new environments. While variations in gene expression in bacteria are easily measured through the use of reporter systems such as green fluorescent proteins and its variants, precise determination of a cell's growth rate, and how it is influenced by its immediate environment, remains challenging. Here, we show that many conflicting and ambiguous definitions of bacterial growth can actually be used interchangeably in E. coli. Indeed, by monitoring small populations of E. coli bacteria inside a microfluidic device, we show that seemingly independent measurements of growth (elongation rate and the average division time, for instance) agree very precisely with one another. We combine these definitions with the population's length and age distribution to very precisely quantify the influence of temperature variations on a population's growth rate. We conclude by using coalescence theory to describe the evolution of a population's genetic structure over time.

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