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Quantifying the robustness of circadian oscillations at the single-cell level GUILLAUME LAMBERT, MICHAEL RUST, University of Chicago — Cyanobacteria are light-harvesting microorganisms that contribute to 30% of the photosynthetic activity on Earth and contain one of the simplest circadian systems in the animal kingdom. In *Synechococcus elongatus*, a species of freshwater cyanobacterium, circadian oscillations are regulated by the KaiABC system, a trio of interacting proteins that act as a biomolecular pacemaker of the circadian system. While the core oscillator precisely anticipates Earth's 24h light/dark cycle, it is unclear how much individual cells benefit from the expression and maintenance of a circadian clock. By studying the growth dynamics of individual *S. elongatus* cells under sudden light variations, we show that several aspects of cellular growth, such as a cell's division probability and its elongation rate, are tightly coupled to the circadian clock. We propose that the evolution and maintenance of a circadian clock increases the fitness of cells by allowing them to take advantage of cyclical light/dark environments by alternating between two phenotypes: expansionary, where cells grow and divide at a fast pace during the first part of the day, and conservative, where cells enter a more quiescent state to better prepare to the stresses associated with the night's prolonged darkness.

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