ESAM SPEAKER

Demand for High Protein Copy Number Can Favor Timers Over Clocks in Bacteria

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Circadian clocks generate 24-hour rhythms that must be reliable although they are based on stochastic biochemical reactions. In bacteria, stochasticity may be a significant constraint on function because protein copy number is limited. Experimentally, we show that in S. elongatus, the model organism for bacterial rhythms, the Kai proteins are normally expressed at high copy number and oscillations in become erratic when protein expression is reduced. The much smaller cyanobacterium Prochlorococcus expresses only a few hundred copies of the Kai proteins and has lost a crucial feedback loop, resulting in a timer-like system that no longer free-runs. Information theoretic analysis shows that this timer strategy can outperform a free-running clock when stochastic effects are important.

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