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Stochastic Modeling of Bacteria Cell Size Control and Homeostasis YANYAN CHEN, Bioengineering Program, Lehigh University, JAVIER BUCETA, Chemical and Biomolecular Engineering Department, Bioengineering Program, Lehigh University — Besides recent breakthroughs, there is a gap of knowledge about the mechanisms underlying cell size control and homeostasis. In this context, recent studies support the incremental rule in rod-shaped bacteria: cells add a constant length to their size before dividing which is independent of their size at birth. This growing pattern, when coupled with the mid-cell division mechanism, leads to size convergence and homeostasis. However, some aberrantly long mutant strains of *E. coli*, e.g. ΔFtsW, do not typically divide at the middle. Whether cell size control and homeostasis apply to those mutant backgrounds, or the role played by biomechanical cues, remain open questions. Here we present a combination of theoretical, experimental, and computational approaches to address these questions. First, we introduce a Markov chain model that describes either wild-type (wt) strains or growth-defective strains. Second, we propose a polymer-like model to account for the mechanical inputs. Finally, we test experimentally some of our predictions by using wt and conditional mutant (ΔFtsW) strains. Altogether, our preliminary studies suggest a way to unify the principles of cell size control and homeostasis of wt and growth-defective cell strains.

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