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*A Multi-stranded Polymer Model Explains
MinDE Dynamics in E. coli Cell Division*

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Abstract

In *Escherichia coli*, the location of the site for cell division is regulated by the action of the Min proteins. These proteins undergo a periodic pole-to-pole oscillation that involves polymerization and ATPase activity of MinD under the controlling influence of MinE. This oscillation suppresses division near the poles while permitting division at midcell. In this talk I will describe a multi-stranded polymer model for MinD and MinE dynamics that quantitatively agrees with the experimentally observed dynamics in wild-type cells and in several well-studied mutant phenotypes. The model also provides new explanations for several phenotypes that have never been addressed by previous modeling attempts. In doing so, the model bridges a theoretical gap between protein structure, biochemistry and mutant phenotypes. Finally, the model emphasizes the importance of non-equilibrium polymer dynamics in cell function by demonstrating how behavior analogous to the dynamic instability of microtubules is used by *E. coli* to achieve a sufficiently rapid time scale in controlling division site selection.