
ELDON EMBERLY, Simon Fraser University
Operational principles of a molecular lawnmower

In many bacteria there is an active process that is responsible for the segregation of genetic material after replication. It is driven by a two protein system that functions like a molecular lawnmower; one protein acts as a substrate that gets processively removed by the other protein. Amazingly, recent experimental work has shown that this system can be reconstituted outside the cell, yielding a functional in vitro molecular machine. In this talk I will present a deterministic model for the in vitro system, showing how noise in the initial conditions is sufficient to lead to the spontaneous formation of a gradient in the substrate concentration that drives directed motion. Our model predicts that the system possesses an optimal speed that depends on the range of the force to the range of substrate removal. When we allow for the removed substrate to recover, two dynamical regimes exist and we predict that it should be possible to observe persistent acceleration in one and the ability to stall the system in the other. We suggest experiments using the in vitro system that could test these predictions.