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Exploration of locomotion in the ParA/ParB system LAVISHA JINDAL, ELDON EMBERLY, Simon Fraser University — In many bacteria the ParA/ParB system is responsible for actively segregating DNA during replication. ParB precessively moves by hydrolyzing DNA bound ParA-ATP forming a depleted ParA region in its wake. Recent in-vitro experiments have shown that a ParB covered bead can traverse a ParA bound DNA substrate. It has been suggested that the formation of a gradient in ParA leads to diffusion-ratchet like motion of the ParB bead but its origin and potential consequences requires investigation. We have developed a deterministic model for the in-vitro ParA/ParB system and show that any amount of spatial noise in ParA can lead to the spontaneous formation of its gradient. The velocity of the bead is independent of this noise but depends on the scale over which ParA exerts a force on the bead and the scale over which ParB hydrolyzes ParA from the substrate. There is a particular ratio of these scales at which the velocity is a maximum. We also explore the effects of cooperative vs independent rebinding of ParA to the substrate. Our model shows how the driving force for ParB originates and highlights necessary conditions for directed motion in the in-vitro system that may provide insight into the in-vivo behaviour of the ParA/ParB system.

Lavisha Jindal
Simon Fraser University

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