Crosstalk between non-processive myosin motors mediated by the actin filament elasticity

Anne Bernheim-Groswasser

Department of Chemical Engineering,
Ben-Gurion University of the Negev, Beer-Sheva 84105, ISRAEL.

Abstract

Many biological processes involve the action of molecular motors that interact with the cell cytoskeleton. Some processes, such as the transport of cargoes, are achieved mainly by the action of individual motors. Other, such as cell motility and division, require the cooperative work of many motors. Collective motor dynamics can be quite complex and unexpected. One beautiful example is the bidirectional ("back and forth") motion of filaments which is induced when the motors within a group exert forces in opposite directions. This review tackles the puzzle emerging from a recent experimental work in which it has been shown that the characteristic reversal times of the bidirectional motion, τ_{rev}, are practically independent of the number of working motors N. This result is in a striking contradiction with existing theoretical models that predict an exponential growth of τ_{rev} with N. We argue that the solution to this puzzle may be related to the crosstalk between the motors that originates from the elastic tensile stress that develops in the cytoskeleton track. The crosstalk between motors does not lead to direct correlations between the motors which attach to and detach from the track independently of each other. It does, however, increases dramatically the detachment rate of the motors which, as a result of the crosstalk, becomes system-size dependent.