

A Hitchhikers Guide through the Cell

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Abstract. How material is transported within our cells is an important question in cell biology and more recently of biophysics. The classical picture of intracellular transport is that of cargos being directly pulled by molecular motors along spatially stationary highways, called microtubules. Based on new experimental observations we propose an alternative mechanism for intracellular cargo transport which results from motor induced longitudinal fluctuations of cytoskeletal microtubules (MT). The longitudinal fluctuations combined with transient cargo binding to the MTs lead to long range transport even for cargos and vesicles having no molecular motors on them. The proposed transport mechanism, which we call “hitchhiking”, provides a consistent explanation for the broadly observed yet still mysterious phenomenon of bidirectional transport along MTs. We show that cells exploiting the hitchhiking mechanism can effectively up- and down-regulate the transport of different vesicles by tuning their binding kinetics to characteristic MT oscillation frequencies.