

# Spatial cytoskeleton organization supports targeted intracellular transport

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The efficiency of intracellular cargo transport from specific source to target locations is strongly dependent upon molecular motor-assisted motion along the cytoskeleton. Radial transport along microtubules and lateral transport along the filaments of the actin cortex underneath the cell membrane are characteristic for cells with a centrosome. The interplay between the specific cytoskeleton organization and the motor performance realizes a spatially inhomogeneous intermittent search strategy. In order to analyze the efficiency of such intracellular search strategies we formulate a random velocity model with intermittent arrest states. We evaluate efficiency in terms of mean first passage times for three different, frequently encountered intracellular transport tasks: i) the narrow escape problem, which emerges during cargo transport to a synapse or other specific region of the cell membrane, ii) the reaction problem, which considers the binding time of two mobile particles within the cell, and iii) the reaction-escape problem, which arises when cargo must be released at a synapse only after pairing with another particle. Our results indicate that cells are able to realize efficient search strategies for various intracellular transport tasks economically through a spatial cytoskeleton organization that involves only a narrow actin cortex rather than a cell body filled with randomly oriented actin filaments.