

1163-92-148

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Modeling the dynamics and organization of intracellular proteins.

Actin filaments are polymers that interact with motor proteins inside cells and play important roles in cell motility, shape, and development. Depending on its function, this dynamic network of interacting proteins reshapes and organizes in a variety of structures, including bundles, clusters, and contractile rings. Motivated by observations from the reproductive system of the roundworm *C. elegans*, we use an agent-based modeling framework to simulate interactions between actin filaments and myosin motor proteins inside cells. We also develop tools based on topological data analysis to understand time-series data extracted from these filamentous network interactions. Our analysis reveals potential mechanistic differences between motor proteins that are believed to shape the organization of various structures inside cells. In addition, we show that changes in actin filament treadmilling may significantly regulate protein organization during cell cycle progression. (Received August 22, 2020)