

## **Insights from including the microtubule cytoskeleton in modelling mRNA localization**

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The cellular cytoskeleton ensures the dynamic transport, localization and anchoring of various proteins and vesicles. In the development of egg cells into embryos, messenger RNA (mRNA) is transported along microtubule filaments and must accumulate at the cortex of the egg cell on a certain time and spatial scale. We present two equivalent methods of deriving the effective transport properties of mRNA at large time: using analysis of partial differential equations, and using renewal rewards processes in a stochastic model formulation. The dynamical systems model approach can be extended to include the geometry of the microtubule filaments. This allows us to better predict the spread of the particles, and to investigate the contribution of an anchoring mechanism to the timescale of localization. Our numerical studies using model microtubule structures predict that anchoring of mRNA-molecular motor complexes may be most effective in keeping mRNA localized near the cortex and therefore in healthy development of oocytes into embryos.

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