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The colloidal hydrodynamics of intracellular transport ROSEANNA ZIA, AKSHAY MAHESHWARI, ALP SUNOL, EMMA GONZALEZ, DREW ENDY, Stanford University — Many representations of intracellular behavior rely on abstractions that do not account for how macromolecules are organized and move inside the cell. For many questions in biology and medicine these simpler models have been sufficient. However, fundamental gaps in understanding of many cell functions persist; physics may provide a bridge to close such gaps. I will discuss our computational and theoretical models of spherically confined colloidal suspensions, as a simple model cell, where biomolecules and their interactions can be physically represented individually and explicitly. A primary challenge in models of confined colloidal suspensions is the accurate and efficient representation of many-body hydrodynamic interactions, Brownian motion, and the enclosure. To this end, we developed the Cellular Stokesian dynamics framework. Utilizing this model, we studied diffusion, cooperative motion, and self-organization with confinement and crowding levels representative of a cell interior. I will discuss the qualitative influence of hydrodynamics, confinement and crowding on transport behavior, as well as the consequences of neglecting such influences. Connections to underlying structure are made, and implications for cellular function are discussed.

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