Abstract Submitted
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A computational model of amoeboid cell swimming in unbounded medium and through obstacles[1] ERIC CAMPBELL, PROSENJIT BAGCHI, Rutgers University — Pseudopod-driven motility is commonly observed in eukaryotic cells. Pseudopodia are actin-rich protrusions of the cellular membrane which extend, bifurcate, and retract in cycles resulting in amoeboid locomotion. While actin-myosin interactions are responsible for pseudopod generation, cell deformability is crucial concerning pseudopod dynamics. Because pseudopodia are highly dynamic, cells are capable of deforming into complex shapes over time. Pseudopod-driven motility represents a multiscale and complex process, coupling cell deformation, protein biochemistry, and cytoplasmic and extracellular fluid motion. In this work, we present a 3D computational model of amoeboid cell swimming in an extracellular medium (ECM). The ECM is represented as a fluid medium with or without obstacles. The model integrates full cell deformation, a coarse-grain reaction-diffusion system for protein dynamics, and fluid interaction. Our model generates pseudopodia which bifurcate and retract, showing remarkable similarity to experimental observations. Influence of cell deformation, protein diffusivity and cytoplasmic viscosity on the swimming speed is analyzed in terms of altered pseudopod dynamics. Insights into the role of matrix porosity and obstacle size on cell motility are also provided.

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