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Quantitative analysis and modeling of cell shape during rapid movement

The crawling movement of eukaryotic cells is driven by dynamic assembly, contraction and disassembly of the actin cytoskeleton. Internal cell structural rearrangements are transduced into forward motion by dynamic cell-substrate adhesions. The forces arising from the actions of cytoskeletal and adhesive cellular components also determine the cell shape. Experimentally, we have found that cell shape and movement behavior are quantitatively coupled for several fast-moving cell types, including fish epidermal keratocytes and human neutrophils. This talk will focus on mathematical methods for quantitative analysis of cell shape changes during rapid motility, and on our current progress toward developing comprehensive physical models that link cell movement and shape determination.