

Cell-substrate-fluctuations enable fast and coherent collective migration

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Collective cell migration emerges from long-range cell-cell communication governed by factors such as force transmission, the viscoelastic properties of individual cells, substrate interactions, and mechanotransduction. Here, we examine how changes in cell-substrate dynamics, adhesion, and traction forces affect the average velocity and spatiotemporal correlations in confluent monolayers of either wild-type MDCK II cells or highly contractile MDCK II cells depleted of zonula occludens 1/2 (dKD). Our data show that confluent dKD monolayers migrate more slowly than WT cells, which is accompanied by increased substrate adhesion, reduced traction forces, a more compact monolayer morphology, weakened cell-cell interactions, and diminished fluctuations in cell-substrate distance. Furthermore, depleting basal actin and myosin reinforces the idea that short-range cell-substrate interactions—specifically, fluctuations driven by the basal actomyosin cytoskeleton—play a key role in determining collective migration speed at larger scales.