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Managing surroundings: cell adaptations to 2D and 3D surfaces that promote movement

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In the canonical model of amoeboid cell migration, the bounds of motility are set by cell-surface adhesion; surface attraction is required for actin mediated extension of pseuodopods to push the cell center of mass forward, yet it must be sufficiently low to allow cells to de-adhere and retract their rear [1]. When collective migration occurs the balance of resistive adhesion forces with protrusive forces is presumably altered as cellcell contact provides an additional mass to push against [2]. Specific integrin binding sites are known to impact focal adhesions during individual migration [3]. In the absence of specific binding sites such as in the social amoeba Dictyostelium, we envision that hydrophobic attraction and electrostatics works in a similar manner [4]. We studied the ability of Dictyostelium discoideum, which migrate individually and collectively, to move on surfaces of varying hydrophobicity and charge. We found that these cells actively regulate their surface contact such that individuals adhere and migrate equally well on surfaces of dramatically varying properties without changing cell shape, indicating the cells "sense" the surface. To find the timing of this adaptation we examine the spreading behavior at the initial surface contact and when the cells transition from one surface to another. In 3D collagen networks cells modify the environment by degrading and crosslinking the surrounding network as well as secreting additional collagen. We present direct visualization of the early network modifications by cancer cell lines in an effort to determine the boundary conditions of the collagen on a cell embedded in a network.