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Physical limits to biomechanical sensing FARZAN BEROZ, CHASE P. BROEDERSZ, NED S. WINGREEN, Princeton University — Experiments have shown that eukaryotic cells such as fibroblasts and mesenchymal stem cells are able to accurately probe and respond to the elastic properties of their microenvironment. These cells navigate across gradients in stiffness, a phenomenon that has been called "durotaxis." Spatial heterogeneity in the cell's elastic environment produces sampling noise in local probing of stiffness, which places fundamental limits on the accuracy with which a cell can sense stiffness gradients. To determine the biophysical limits of durotaxis, we develop a quantitative model of a cell as a stiffness-measuring device interacting with a disordered fiber network in two and three dimensions. We find that local stiffness measurements follow a broad distribution spanning several orders of magnitude.

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