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Cell stretching in extensional flows for assaying cell mechanics DANIEL GOSSETT, HENRY TSE, OLADUNNI ADEYIGA, OTTO YANG, JIANYU RAO, DINO DI CARLO, University of California, Los Angeles — There is growing evidence that cell deformability is a useful indicator of cell state and may be a label-free biomarker of metastatic potential, degree of differentiation, and leukocyte activation. In order for deformability measurements to be clinically valuable given the heterogeneity of biological samples, there exists a need for a high-throughput assay of this biophysical property. We developed a robust method for obtaining high-throughput (>1,000 cells/sec) single-cell mechanical measurements which employs coupled hydrodynamic lift forces and curvature-induced secondary flows to uniformly position cells in flow, extensional flow stretching, high-speed imaging, and automated image analysis to extract diameter and deformability parameters. Using this method we have assayed numerous in vitro models of cellular transformations and clinical fluids where malignant cells manifest. We found transformations associated with increased motility or invasiveness increased deformability and the presence of large and deformable cells within clinical pleural fluids correlated well with cytological diagnoses of malignancy. This agrees with the hypothesis that cancerous cells are deformable by necessity–to be able to transverse tight endothelial gaps and invade tissues.

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