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Stiffness Dependent Separation of Cells in a Microfluidic Device

TODD SULCHEK, GONGHAO WANG, WENBIN MAO, CAITLIN HENEGAR, ALEXANDER ALEXEEV, Georgia Tech — Abnormal cell mechanical stiffness can point to the development of various diseases including cancers and infections. We report a new high-throughput technique for continuous cell separation utilizing variation in cell stiffness. We use a microfluidic channel decorated by periodic diagonal ridges to separate K562 lymphoblastic cell line modified to different mechanical stiffness values. Diagonal ridges within the microfluidic flow channel compress and deform the cells in rapid succession to translate each cell perpendicular to the channel axis in proportion to its stiffness. Atomic force microscopy (AFM) was used to directly measure the Young's modulus of modified K562 cells to verify the stiffness variation. We demonstrate that soft cells can be separated from stiff cells at physiological concentrations with a fivefold enrichment of cell populations. This microfluidic device opens the way for conducting rapid and low-cost cell analysis and purification through physical markers.

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