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Effect of Strain Rate on the Mechanical Behavior of Red Blood Cells Entering a Constriction JORDAN MANCUSO, WILLIAM RISTENPART, Dept. Chemical Engineering and Materials Science, University of California Davis — Most work on the effect of hydrodynamic stress on red blood cells (RBCs) has focused on linear velocity profiles. Microfluidic devices have provided a means to examine the mechanical behavior of RBCs undergoing a sudden increase in shear stress at the entrance of a constriction, with previous work primarily focused on a fixed constriction taper angle and corresponding hydrodynamic strain rate. Here we investigate the effect of strain rate on the stretching dynamics exhibited by RBCs as they enter a microfluidic constriction. Systematic variations in the constriction taper angle allow the strain rate to be precisely tuned, and high speed video yields precise measurements of the corresponding RBC deformations. We demonstrate that maximal RBC stretching occurs at an intermediate constriction taper angle, despite the lower magnitude of the strain rate. We interpret the results in terms of the time integral of the elongational strain rate, and we discuss the implications for shear-induced mechanotransduction.

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