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**Red Blood Cell Deformation Under Shear Flow: The Effect of Changing Cell Properties** ALISON M. FORSYTH, JIANDI WAN, Harvard University, WILLIAM D. RISTENPART, UC Davis, HOWARD A. STONE, Harvard University — The deformability of red blood cells plays a major role in the pathology of several diseases, including malaria, sickle cell anemia and spherocytosis. Moreover, deformations are believed to trigger the release of adenosine triphosphate, which helps regulate vascular tone and is consequently an important factor in various vascular diseases. Here we investigate single-cell viscoelastic responses to increased shear stress in poly(dimethylsiloxane) channels with a single constriction 2-4 times larger than a typical erythrocyte. These channels mimic arteriole-sized vessels, and have the advantage that the cell membrane is not in contact with the channel walls which have vastly different mechanical and material properties than living tissue. High-speed video and image analysis were used to quantify the trajectories and deformations of cells exposed to varied doses of diamide, a chemical known to “rigidify” erythrocytes. Our results show that (i) deformation is proportional to shear rate and (ii) the deformability of diamide-treated cells is greater than that of untreated cells. The latter is an unforeseen result because micropipette aspiration experiments have shown the opposite. We expect that the experimental procedure described here will be useful for characterizing the effect of different therapeutic agents on cellular deformability.

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