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A Microfluidic Approach for Studying Shear-induced ATP Release Kinetics from Red Blood Cells JIANDI WAN, WILLIAM D. RISTENPART, CATHERINE BEST, RENITA HORTON, GUIDO GUIDOTTI, EDWARD H. ABRAHAM, HOWARD A. STONE, Harvard University — To understand the influence of shear stress on the kinetics of adenosine triphosphate (ATP) release from red blood cells (RBCs), we mimic arterial constrictions using a series of channels in microfluidic devices. The shear stress and duration of stress are systematically varied in different devices by changing the width and length of the constriction channels respectively. We show that the amount of released ATP increases roughly exponentially with the magnitude of the shear stress, but that there is a critical duration of stress (2 ms) required for RBCs to release significant amounts of ATP. The results suggest that RBCs are sensitive not only to the diameter of arterial constrictions but to their length, an effect with important physiological and medical implications. This work also motivated a new approach for using microfluidic methods for the measurement of enzyme kinetics, which we mention briefly.

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