Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

**The Contribution of Red Blood Cell Dynamics to Intrinsic Viscosity and Functional ATP Release** ALISON FORSYTH, Princeton University, MANOUK ABKARIAN, Université Montpellier 2, JIANDI WAN, HOWARD STONE, Princeton University — In shear flow, red blood cells (RBCs) exhibit a variety of behaviors such as rouleaux formation, tumbling, swinging, and tank-treading. The physiological consequences of these dynamic behaviors are not understood. *In vivo,* ATP is known to signal vasodilation; however, to our knowledge, no one has deciphered the relevance of RBC microrheology to the functional release of ATP. Previously, we correlated RBC deformation and ATP release in microfluidic constrictions (Wan *et al.*, 2008). In this work, a cone-plate rheometer is used to shear a low hematocrit solution of RBCs at varying viscosity ratios ($\lambda$) between the inner cytoplasmic hemoglobin and the outer medium, to determine the intrinsic viscosity of the suspension. Further, using a luciferin-luciferase enzymatic reaction, we report the relative ATP release at varying shear rates. Results indicate that for $\lambda =$ 1.6, 3.8 and 11.1, ATP release is constant up to 500 $s^{-1}$, which suggests that the tumbling-tanktreading transition does not alter ATP release in pure shear. For lower viscosity ratios, $\lambda = 1.6$ and 3.8, at 500 $s^{-1}$ a change in slope occurs in the intrinsic viscosity data and is marked by an increase in ATP release. Based on microfluidic observations, this simultaneous change in viscosity and ATP release occurs within the tank-treading regime.

Howard Stone
Princeton University

Date submitted: 05 Aug 2010 Electronic form version 1.4