Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Matrix viscoplasticity and its shielding by active cell mechanics in engineered microtissues[1] ALAN LIU, Johns Hopkins University, HAILONG WANG, University of Science and Technology of China, CRAIG COPELAND, NIST, Gaithersburg, MD, CHRISTOPHER CHEN, Boston University, VIVEK SHENOY, University of Pennsylvania, DANIEL REICH, Johns Hopkins University — The physical interplay between cells and the surrounding extracellular matrix under mechanical stimulation is critically important to physiological function. To elucidate this interaction, we combined experiments on 3D bioengineered bovine smooth muscle microtissues with mathematical modeling to reveal a heretofore unappreciated interplay between active cell mechanics and matrix viscoplasticity.[2] When stretched on magnetically actuated microcantilever force sensors, the microtissues response was dominated by the cells' actomyosin dynamics, which shielded an underlying viscoplastic response of the matrix that was revealed upon cell lysis. This behavior is quantitatively described by a model that couples Hill-type actomyosin dynamics with plastic perfectly viscoplastic matrix dynamics. Actuation experiments on single cells confirmed the active cell dynamics and were described by a single-cell version of the model. These results suggest the need for new focus on matrix plasticity to describe tissue dynamics.

[1]Supported by NSF Grants CMMI-1463011 and CMMI-1462710, and NIH Grants R01HL90747, U01CA202177, U54CA193417, and R01EB017753. HW acknowledges support from the Thousand Young Talents Program of China.
[2]A. S. Liu *et al.*, Sci. Reports **6**, 33919 (2016).

Daniel Reich
Johns Hopkins University

Date submitted: 10 Nov 2016 Electronic form version 1.4