Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Effects of geometry and cell-matrix interactions on the mechanics of 3D engineered microtissues[1] PRASENJIT BOSE, Johns Hopkins University, JEROEN EYCKMANS, CHRISTOPHER CHEN, Boston University, DANIEL REICH, Johns Hopkins University — Approaches to measure and control cell-extracellular matrix (ECM) interactions in a dynamic mechanical environment are important both for studies of mechanobiology and for tissue design for bioengineering applications. We have developed a microtissue-based platform capable of controlling the ECM alignment of 3D engineered microtissues while simultaneously permitting measurement of cellular contractile forces and the tissues' mechanical properties. The tissues self-assemble from cell-laden collagen gels placed in micro-fabricated wells containing sets of flexible elastic pillars. Tissue geometry and ECM alignment are controlled by the pillars' number, shape and location. Optical tracking of the pillars provides readout of the tissues' contractile forces. Magnetic materials bound to selected pillars allow quasi-static or dynamic stretching of the tissue, and together with simultaneous measurements of the tissues' local dynamic strain field, enable characterization of the mechanical properties of the system, including their degree of anisotropy. Results on the effects of symmetry and degree of ECM alignment and organization on the role of cell-ECM interactions in determining tissue mechanical properties will be discussed.

[1]This work is supported by NSF CMMI-1463011 and CMMI-1462710.

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Date submitted: 11 Nov 2016

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