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APS March Meeting 2021

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Session V09: Mechanics and Structure of Filament Networks: Tissues and Cytoskeleton

3:00 PM–6:00 PM, Thursday, March 18, 2021

Sponsoring Unit: DSOF

Chair: Alex Levine, University of California; Christoph Schmidt, Duke University

Abstract: V09.00005 : Cells utilize strain hardening and crosslinking to establish their extracellular niche in fibrous tissue

5:24 PM–6:00 PM

Live

← Abstract

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Bulk measurements of ECM stiffness are commonly used in mechanobiology. However, peri-cellular stiffness can be quite heterogenous and divergent from the bulk properties. Here, we use optical tweezers active microrheology (AMR) to quantify how two different cell lines embedded in 1.0 and 1.5 mg/ml type 1 collagen (T1C) establish dissimilar patterns of peri-cellular stiffness. We found that dermal fibroblasts (DFs) increase local stiffness of 1.0 mg/ml T1C hydrogels, but surprisingly do not alter stiffness of 1.5 mg/ml T1C hydrogels. In contrast, MDA-MB-231 cells (MDAs) predominantly do not stiffen T1C hydrogels, as compared to cell-free controls. Results suggest that MDAs adapt to the bulk ECM stiffness, while DFs regulate local stiffness to levels they intrinsically “prefer”. Further, cells were subjected to treatments, that were previously shown to alter migration, proliferation and contractility of DFs and MDAs. Following treatment, both cell lines established different levels of stiffness magnitude and anisotropy, which were dependent on the cell line, T1C concentration and treatment. In summary, our findings demonstrate that AMR reveals otherwise masked mechanical properties such as spatial gradients and anisotropy, which are known to affect cell behavior at the macro-scale.

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