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Effects of Matrix Alignment and Mechanical Constraints on Cellular Behavior in 3D Engineered Microtissues.[1] PRASENJIT BOSE, Johns Hopkins University, JEROEN EYCKMANS, CHRISTOPHER CHEN, Boston University, DANIEL REICH, Johns Hopkins University — The adhesion of cells to the extracellular matrix (ECM) plays a crucial role in a variety of cellular functions. The main building blocks of the ECM are 3D networks of fibrous proteins whose structure and alignments varies with tissue type. However, the impact of ECM alignment on cellular behaviors such as cell adhesion, spreading, extension and mechanics remains poorly understood. We present results on the development of a microtissue-based system that enables control of the structure, orientation, and degree of fibrillar alignment in 3D fibroblast-populated collagen gels. The tissues self-assemble from cell-laden collagen gels placed in micro-fabricated wells containing sets of elastic pillars. The contractile action of the cells leads to controlled alignment of the fibrous collagen, depending on the number and location of the pillars in each well. The pillars are elastic, and are utilized to measure the contractile forces of the microtissues, and by incorporating magnetic material in selected pillars, time-varying forces can be applied to the tissues for dynamic stimulation and measurement of mechanical properties. Results on the effects of varying pillar shape, spacing, location, and stiffness on microtissue organization and contractility will be presented.

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