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Engineered Microenvironments to Investigate Cellular Behavior

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Abstract—**Numerous in vivo morphogenetic processes such as angiogenesis occur within a three-dimensional context, where both soluble growth factor-mediated and insoluble adhesive signals modulate cellular behaviors such as proliferation, differentiation, and apoptosis. Using microfabrication approaches to engineer the multidimensional cellular microenvironment, we are examining how these adhesive and growth factor cues interact and synergize to regulate dynamic cell signaling, gene expression, cell proliferation, and migration. Here, we demonstrate a novel microfabricated platform to culture cells within three-dimensional collagen gels that enables the spatial organization of single cells and multicellular aggregates. Our results suggest that in addition to the matrix environment, the spatiotemporal dynamics of a stimulus signal can influence intracellular signaling and subsequent cell behavior. These systems enable fundamental insights into how cells integrate mechanochemical signals from their environment in order to coordinate downstream functions.**

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