O-28.6 Short talk

Multiphoton Lithography Scaffolds for Time-Resolved Mesenchymal Stem Cells Differentiation Studies at the Molecular Level

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We present a new 3D hybrid tissue scaffold for organ-on-a-chip applications, combining bioactive methacrylated collagen type I and biocompatible synthetic methacrylate-based photoresists, fabricated using advanced multiphoton lithography. This scaffold mimics bone mechanics and offers precise control over material properties, enabling single-cell confinement and long-term observation (up to 21 days). The scaffold's tunable mechanical properties, achieved by incorporating PEGDA as a cross-linking agent, allow for time-dependent changes in geometry, while resembling specific tissue types. Our results demonstrate that this scaffold supports osteogenic differentiation of mesenchymal stem cells in 3D, with enhanced marker expression and biodegradation of the Coll-MA structures, while guiding cell growth during differentiation. Using atomic force & single molecule localization microscopy, and confocal imaging, we characterized the scaffold's mechanical properties, biofunctionality, and cellular interactions. Our study highlights the scaffold's potential for studying cellular dynamics and tissue engineering in microfluidic and organ-on-a-chip applications.