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Polymeric Nanocomposite that Mimics in vivo ECM Topography in Tissue using Magnetic Field-induced Particle Self-assembly. JIYUN KIM, JACK STAUNTON, KANDICE TANNER, National Institutes of Health — 3D biomaterials that mimic a certain physical or chemical aspect of cellular environment have been used to recreate the diversity of the tissue microenvironment. Especially, physical characteristics of these materials such as topography, dimension and stiffness, have known to have crucial effects on cell fate and cell malignancy. Here, we propose a technique that is able to create diverse topographies in 3D polymeric scaffold for the purpose of mimicking the structural aspect of tissue microenvironment. To achieve this, we exploit the magnetic field-directed assembly of super paramagnetic particles to fabricate chain-distributed architecture such that we can study the effects of extracellular matrix (ECM) topography on cell behavior. First, we chemically cross-link proteins including fibronectin, laminin and bovine albumin serum on the surface of magnetic particles to make the building blocks for artificial topography. Then, we assemble these particles by applying the parallel magnetic field in a surrogate polymeric matrix and solidify the matrix to maintain the assembled topography. Using this simple technique, we patterned diverse topographies in 3D including globular, fibril or interfaced architectures without chafing other material characteristics of the scaffold matrix, such as stiffness and molecular diffusion. We demonstrated that the fibril architecture guilds the dendritic extension of fibroblasts and neuron-like cells, compared to the cells grown in the globular architecture lacking anisotropic guidance cues.

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