Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Webinar

3D Printing Cellular Communities: Mammalian Cells, Bacteria, and Beyond

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While the motion and collective behavior of cells are well-studied on flat surfaces or in unconfined liquid media, in most natural settings, cells thrive in complex 3D environments. Bioprinting processes are capable of structuring cells in 3D and conventional bioprinting approaches address this challenge by embedding cells in bio-degradable polymer networks. However, heterogeneity in network structure and biodegradation often preclude quantitative studies of cell behavior in specified 3D architectures. Here, I will present a new approach to 3D bioprinting of cellular communities that utilizes jammed, granular polyelectrolyte microgels as a support medium. The self-healing nature of this medium allows the creation of highly precise cellular communities and tissue-like structures by direct injection of cells inside the 3D medium. Further, the transparent nature of this medium enables precise characterization of cellular behavior. I will describe two examples of my work using this platform to study the behavior of two different classes of cells in 3D. First, I will describe how we interrogate the growth, viability, and migration of mammalian cells—ranging from epithelial cells, cancer cells, and T cells—in the 3D pore space. Second, I will describe how we interrogate the migration of E. coli bacteria through the 3D pore space. Together, these studies highlight how the jammed microgel medium provides a powerful platform to design and interrogate complex cellular communities in 3D—with implications for tissue engineering, microtissue mechanics, studies of cellular interactions, and biophysical studies of active matter.

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