Microfluidic Microstructured Materials

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Hosted by Prof. Ali Khademhosseini

Abstract:
Conventional microparticle fabrication technologies have had a trade-off between complexity and throughput. For example, 3D printers achieve high levels of complexity but require significant time to produce a part, while lithography-based approaches are limited to mostly 2D shapes. We have developed innovative microfluidic approaches to manufacture 3D-shaped microstructured materials at rates orders of magnitude faster than 3D printing technologies. By applying inertial flow sculpting of a polymer precursor using fluid programming techniques entirely new classes of 3D microscale materials can be manufactured. We have also created a software package, called uFlow, to predict 3D-microparticle shape in real-time. New classes of particles should accelerate a range of new material applications where particle microscale shape influences higher-level function of an emergent material. We have also started making use of the aggregate properties of assemblies of microparticles for tissue engineering. We have applied microfluidically-generated hydrogel microspheres that are then covalently linked at their points of contact in situ or within a wound to form a solid contiguous material scaffold with porosity defined by the void spaces between linked gel microspheres. Overall, this approach accelerates wound healing and reduces fibrosis in vivo, bypassing trade-offs present in conventional materials between material porosity, injectability, and mechanics.

Biography:
Dino Di Carlo received his B.S. in Bioengineering from UCB in 2002 and received a Ph.D. in Bioengineering from the UCB and UCSF in 2006. He has been on the faculty in the Department of Bioengineering at UCLA since 2008 where he pioneered using inertial fluid dynamic effects for the control, separation, and analysis of cells in microfluidic devices. His work now extends into numerous fields of biomedicine and biotechnology including directed evolution, cell analysis for rapid diagnostics, single-molecule assays, next generation biomaterials, and phenotypic drug screening. He has also been a leader in technology entrepreneurship: He co-founded and currently advises five companies that are commercializing UCLA intellectual property developed in his lab (CytoVale, Vortex Biosciences, Tempo Therapeutics, Forcyte Biotechnologies and Ferrologix).

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