Cell Engineering for Tissue Regeneration

ABSTRACT: Cell engineering has tremendous potential for regenerative medicine, disease modeling and drug screening. We are interested in understanding how biophysical and biochemical factors in the microenvironment regulate stem cell functions and cell reprogramming, and apply the knowledge and technologies to regenerative medicine applications. Cell source with sufficient quantity remains a challenge for the regeneration of muscle and many other tissues. In a recent study, we identified a chemical cocktail that selectively induced a robust expansion of myogenic stem cells from an easily obtainable dermal fibroblast population and from muscle stromal cells. Lineage tracing showed that Pax7+ cells were the major source of chemical-induced myogenic cells. These cells could be expanded in vitro and used to engraft myofibers upon transplantation. The chemical cocktail was also loaded into injectable nanoparticles to enable a controlled and sustained release in injured muscle, which promoted muscle regeneration by expanding resident satellite cells in situ. Furthermore, we encapsulated the drug delivery nanoparticles into microgels by using a microfluidic system to create a tunable scaffold, which enabled cell infiltration and the tuning of cell functions for tissue regeneration. These findings may lead to the development of novel in vitro and in situ stem cell engineering approaches for effective tissue regeneration.

BIOGRAPHY: Dr. Song Li got his B.S. and M.S. from Peking University, and had his Ph.D. and postdoctoral training at UC San Diego with Professor Shu Chien. Dr. Li was a professor in bioengineering at UC Berkeley between 2001 and 2015. In 2016, he moved to UC Los Angeles as a Chancellor Professor of Bioengineering and Medicine, and he serves as the Chair of the Department of Bioengineering. Dr. Li’s research is focused on stem cell engineering, mechanobiology and tissue engineering. The work from his laboratory has made significant contribution to the understanding of how biophysical factors regulate the vascular functions, stem cell differentiation and cell reprogramming. His laboratory also engineered biophysical factors, stem cells and biomimetic and functional micro/nanomaterials for tissue engineering and drug delivery. Dr. Li is also actively involved in the translation of research findings into technologies to benefit the society. Dr. Li has been elected as a Fellow of American Institute of Medical and Biological Engineering, a Fellow of Biomedical Engineering Society, and a Fellow of the International Academy of Medical and Biological Engineering.