OMICS Group Conferences
Accelerating Scientific Discovery
3rd World Congress on
Cell Science & Stem Cell Research
November 20- 22, 2013 DoubleTree by Hilton Baltimore-BWI Airport, USA

# Cardiovascular applications of tissue engineering scaffolds using biodegradable polymers

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## Abstract

Biodegradable 3D polymer scaffolds made from poly-lactic acid (PLA) or polycaprolactone (PCL) have been widely used in orthopedic tissue engineering. As lots of research is populating in cardiovascular area, we will describe two applications of polymer scaffolds in this hot field. The first example is the culture of freshly isolated mouse adipose-derived stromal cells (ADSCs) on oxygen plasma treated PLA scaffolds. ADSCs express stem cell and endothelial progenitor cell markers before 3D culture. After cells grew on treated PLA scaffolds, they had increased levels of VEGF, COX-2 and MMP-2. The results showed that oxygen plasma treated PLA scaffolds support the growth of ADSCs and induce cell differentiation into endothelial cells. The second case is engineering cell-mediated calcium deposits on PCL scaffolds for an atherosclerotic rabbit model. TGF-β1 was loaded onto scaffolds, and primary human osteoblasts were cultured on top of PCL struts. Low dose (5 ng/scaffold) of TGF-β1 showed to induce most calcification, high DNA synthesis, and ALP activity on cell-polymer construct. When cell-PCL scaffold was implanted into rabbit artery via catheterization technique, a calcified atherosclerotic model was established that mimics the clinical features of human atherosclerosis, namely cell-mediated calcium deposits, chronic inflammatory response, and micro-vessel growth inside atherosclerosis occlusion sites. These two studies showed the potential wide application of biodegradable polymers in the regeneration of cardiovascular tissues.

## Biography

The above projects were done during Beili Zhu's Ph.D. studies. She pursues research under the supervision of C. Mauli Agrawal Ph.D. at Department of Biomedical Engineering and Steven R. Bailey M.D. at Division of Cardiology at The University of Texas Health Science Center at San Antonio, USA. Dr. Zhu has published more than 8 peer reviewed journal articles and book chapters. She is currently an active reviewer for several high impact factor journals in the biomedical engineering field. Dr. Zhu is also the co-chair of a conference session at Cell Science 2011.