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Biomaterials for stem cell tissue engineering

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Stem cells have become a promising cell source in the tissue engineering field. Intense studies have been focused at the cell and molecular biology levels on understanding the relationship between stem cell growth and terminal differentiation in an effort to control these processes. Recent discoveries have shown that the microenvironment can influence stem cell self-renewal and differentiation, which has had a tremendous impact on identifying potential strategies for using these cells effectively in the body. This presentation will describe studies examining the influence of biomaterials on stem cell behavior with an emphasis on biomaterials design and chemistry that impart appropriate cues to stem cells to affect their behavior. Specifically, surface wettability can influence stem cell osteogenesis, which is relevant for bone repair applications. Hydrophobic polymers and their use with bioactive ceramics to create bioactive composites have been identified to greatly enhance the expression of bone cell markers. Biomaterial design such as fiber and pore size dimension can also greatly influence differentiation. Studies using electrospun polylactic acid (PLLA) having fiber dimensions varying from the nano to micron-scale influenced chondrogenic differentiation of stem cells. The resulting changes in pore size also had a significant effect, but variations in mechanical properties played a minor role. The effect of electromechanical properties of polymeric materials, specifically piezoelectric polymers, on stem cell differentiation along bone, cartilage and neural lineages will also be discussed.

Biography

Dr. Arinzeh received her B.S. from Rutgers University, New Brunswick, NJ in Mechanical Engineering, her M.S.E. in Biomedical Engineering from Johns Hopkins University, and her Ph.D. in Bioengineering from the University of Pennsylvania. She worked for several years as a project manager at a stem cell technology company, Osiris Therapeutics, Inc. Dr. Arinzeh joined the faculty of the New Jersey Institute of Technology (NJIT) in 2001 as one of the founding faculty members of the department of Biomedical Engineering. Dr. Arinzeh has been recognized with numerous awards, including the National Science Foundation CAREER Award in 2003, Presidential Early Career Award for Scientists and Engineers (PECASE) in 2004, Outstanding Scientist Award from the NJ Association for Biomedical Research in 2004, People to Watch in 2005 in *The Star Ledger* and the Coulter Foundation Translational Award in 2010. Her research support is from the National Science Foundation, Coulter Foundation, Musculoskeletal Transplant Foundation, New Jersey Commission on Science and Technology, New Jersey Commission on Spinal Cord Repair and medical device/biotechnology companies.