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Nanofiber scaffolds as an ex-vivo method for cd34+ hematopoietic progenitor stem cell (hpc) growth and expansion

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Current treatment of Sickle Cell Disease (SCD) involves either a bone marrow or a stem cell transplant. The issues involved with bone marrow transplants, such as graft failure or difficulty in donor matching, suggest that stem cell transplants may be a more effective treatment approach. This work presents an ex-vivo approach for expansion of progenitor cells in the treatment of SCD. Nanofiber scaffolds incorporating Matrigel® and Notch-ligand have been developed to support CD34+ hematopoietic progenitor stem cell (HPC) growth and expansion. These nanofiber scaffolds were constructed using a 15% poly (ϵ -caprolactone) (PCL)-8% chitosan (CS) blend. Various nanofiber constructs were fabricated consisting of bulk and core-shell orientations. FTIR was used to confirm the chemical composition of the scaffolds with characteristic bands attributed to chitosan and PCL, respectively. XRD analysis showed the formation of a semi-crystalline construct, with diffraction peaks corresponding to both PCL and chitosan occurring at 21.4, 23.7, and 38.5° 2 θ . The surface morphologies of the scaffolds were studied using SEM, TEM, and CLSM and it was observed that the fibers are aligned, uniform, and measure between 100-400 nm in diameter. Cell viability studies show that the addition of Notch-ligand and matrigel into the nanofiber scaffold has a positive effect on cell survival rates (>90%). Qualitative and quantitative properties of the CD34+ populations were determined by flow cytometry. Preliminary findings show that the developed PCL-CS scaffolds show promise as successful substrates for enrichment and expansion of CD34+ hematopoietic stem cells.

Biography

Dr. Winstead completed her Ph.D. at Virginia Polytechnic Institute & State University (Virginia Tech). She is Associate Professor and Chair of the Department of Chemistry at Delaware State University. She has secured over 8.8 million in funding on projects on which she has served PI, Co-PI or key personnel. Dr. Winstead is a member of the American Chemical Society (ACS) and a reviewer for the National Science Foundation and International Journal for NanoMedicine.

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