Expansion of Adipose-derived Stem Cells Using a Novel 3D Cell Expansion System for Stem Cell Therapy

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Stem cell therapy requires millions to billions of stem cells grown in GMP level facilities. The microenvironment of cells can affect the yield and quality of stem cells used for therapy. Large-scale culture and expansion of stem cells by the conventional 2-dimensional (2D) method is difficult and known to have many challenges. Furthermore, 2D cell culture does not depict the 3-dimensional (3D) microenvironment of cells. Growing cells in 3D more closely mimics the physiological condition of cells. At 3D Biotek we have developed a 3D cell expansion system (3D-CES) consisting of polystyrene scaffolds and a perfusion bioreactor that allows for large-scale expansion of anchorage-dependent cells in a 3-dimensional microenvironment. Here, we show that adipose-derived stem cells (ASCs) can be expanded from approximately 10 million to 200-300 million cells in 2-3 weeks in media containing serum and in under 2 weeks in serum free conditions. After expansion, ASCs maintain their cell identity and "stemness" and can be induced to differentiate into chondrocytes, osteocytes, and adipocytes. Furthermore, karyotyping displayed a normal karyotype with 22 pairs of autosome and one XX chromosomes after expansion. Using our bioreactor not only were we able to expand stem cells, but compared to other bioreactors currently being used, our system has much better ease of use and minimizes space, reagents, labor and ultimately cost without affecting quality and ultimately result in the potential for large scale expansion of stem cells for stem cell therapy and biobanking.