Abstract

In the last decade, the regenerative ability of stem and progenitor cells has been demonstrated in several types of tissue. Endothelial progenitor cells (EPCs), which are naturally present in circulating blood, are an especially interesting cell type because they have the ability to repair damaged blood vessels. EPCs have been utilized as precursors in the in vitro cultivation of vascular grafts. As tissue engineering and cell-based therapeutics begin the transition from the laboratory to clinical applications, the availability of robust and simple cell isolation techniques becomes significant. The use of antibody coated channels for cell capture in microfluidic devices has recently been applied to several applications. The principal goal this thesis is to create microfluidic cell separations systems to isolate or enrich key cell types for tissue engineering applications. In tissue engineering functional cell types must be enriched prior to seeding onto scaffolds. In cell based approaches to tissue repair and regeneration stem and progenitor cells present in certain types must be isolated and characterized prior to use. The adhesion of cells to a functionalized surface is the basis for this type of separation. By virtue of their micro scale geometries microfluidic devices have large surface area to volume ratios; this characteristic makes them particularly suitable for adhesion based separation processes. Highly specific cell-ligand interactions have been identified and can be utilized to enact cell separations for specific subpopulations. The ability to release captured cells has been a challenge. Recently it has been demonstrated. Microfluidic channels were coated with alginate gel conjugated with the CD34. Cells were captured from a flow stream by this coating. The cells were then released by flowing EDTA solution.