

A high-throughput polymer microarray approach for identifying defined substrates for mesenchymal stem cells

Abstract

Mesenchymal stem cells (MSCs) hold great promise in regenerative medicine due to their wide multilineage potential as well as their ability to suppress/modulate the immune response. Maintaining these cells in vitro and expanding them on a clinically relevant scale remains a challenge that needs to be addressed to realise their full potential. Current culture methods for MSCs typically rely on animal sourced substrates and often result in a heterogeneous population of cells with varying degrees of differentiation capacity. Here, a high-throughput platform was used to identify synthetic substrates for MSC culture that not only facilitated growth but also maintained the MSC phenotype. Two polymers, PU157 (synthesised from poly(butylene glycol) and 4,4'-methylenediphenyldiisocyanate with 3-(dimethylamino)-1,2-propanediol as a chain extender) and PA338 (N-methylaniline modified poly(methylmethacrylate-co-glycidylmethacrylate)) were able to maintain the growth and phenotype of human embryonic derived mesenchymal progenitors (hES-MPs) and adipose derived MSCs (ADMSCs) for five and ten passages, respectively. Cell phenotype and multipotency were confirmed by flow cytometry analysis of ten MSC markers and differentiation analysis. These new polymer substrates provide a chemically defined synthetic surface for efficient, long-term MSC culture.