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Understanding Cell Shape Phenotypes Associated with Stem Cell Differentiation Induced by Topographical Cues of Nanofiber Microenvironment. DESU CHEN, University of Maryland, SUMONA SARKAR, National Institute of Standards and Technology, WOLFGANG LOSERT, University of Maryland — It is increasingly important to understand cell responses to bioinspired material structures and topographies designed to guide cell functional alterations. In this study, we investigated association between early stage cell morphological response and osteogenic differentiation of human bone marrow stromal cells (hBMSCs) induced by poly(ε-caprolactone) (PCL) nanofiber scaffolds (PCL-NF). Accounting for both multi-parametric complexity and biological heterogeneity, we developed an analysis framework based on support vector machines and a multi-cell level averaging method (supercell) to determine the most pronounced cell shape features describing shape phenotypes of cells in PCL-NF compared to cells on flat PCL films. We found that smaller size and more dendritic shape were the major morphological responses of hBMSCs to PCL-NF on day 1 of cell culture. Further, we investigated the shape phenotypes of hBMSCs in PCL-NF of different fiber densities to monitor the transition between 2-D and 3-D topographies. We tracked the genotypic, phenotypic and morphological responses of hBMSCs to different fiber densities at multiple time points to identify correlations between hBMSCs differentiation and early stage morphology in PCL-NF scaffolds.

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