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Control of stem cell fate on biphasic polyurethane matrices

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Polyurethanes are biphasic in structure due to the presence of different segments which exhibits distinct physicochemical and morphological characteristics. Segmental structure of polyurethanes is derived from different components which constitutes soft and hard segment. Physical and chemical interactions between the segments create biphasic morphology with nano-structured domains. Size, shape and orientation of these domains are controlled by polyurethane structure and composition. Thus, matrices designed from polyurethanes can present distinct morphological features to cells at nano-scale dimension. Structural and functional signals sensed by cells due to this nano-structured polyurethane phase morphology can be utilized to control the fate of stem cells for regenerative applications. Biodegradable polyester urethanes designed from biocompatible polyester soft segment with aliphatic diisocyanate and dipeptide chain extender has shown distinct nano-structured biphasic morphology. These morphological features were engineered to regulate bone-marrow derived mesenchymal stem cells (MSCs). Specifically, MSCs responded to the polyurethane matrix morphology to exhibit distinct cellular behavior including cell morphology, adhesion, migration, and differentiation. Interaction of between stem cells and polyurethane matrices can, therefore, be tuned by polyurethane phase morphology to provide specific cues to stem cells. These polyurethane matrices introduce a new control feature for regulating various cellular functions in a controlled manner and would have applications in regenerative medicine.

Biography

Debanjan Sarkar is an Assistant Professor in the Department of Biomedical Engineering at University at Buffalo, State University of New York. He completed his Ph.D. from University of Akron and postdoctoral studies from Harvard Medical School, Brigham and Women's Hospital. His research focuses on biomaterial based engineering of stem cell for tissue engineering and drug delivery. He has published more than 15 papers in reputed journals, and has 5 patent applications. Additionally, he has coauthored several book chapters and presented in many conferences.

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