

Multi-scale Biomaterials to Direct Stem Cell Fates and Tissue Engineering

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The field of regenerative medicine and tissue engineering strides to create replacement tissues. Stem and progenitor cells can differentiate into various specific cells. There is a growing recognition of 3D matrix microenvironments in regulating the fate and function of stem cells, where biomaterials play a key role. One daunting challenge is to recapitulate the microenvironments in a developmental or healing program to maintain stemness, to accelerate proliferation, or to direct stem cell lineage specification. Our lab designs biodegradable polymeric biomaterials inspired by the extracellular matrix (ECM) to modulate 3D microenvironments on the macro, micro, nano and molecular scales for stem cells to regenerate tissues and organs. We also regulate immune cells to enhance regeneration. Examples of bone, cartilage, dental and cardiovascular tissue regeneration will be presented to demonstrate the impact of ECM-inspired multi-scale biomaterials in tissue engineering.