

## **Materials to Regulate Cell Fate *In Vitro* and *In Vivo***

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Spatially and temporally regulated signaling between and within cell populations and their environment regulate cell fate and tissue regeneration, and artificial microenvironments that mimic this signaling may be useful to directly intervene and drive these processes. Polymeric microenvironments are constructed to provide specific signaling cues (e.g., adhesion peptides, morphogens) in a spatiotemporally controlled manner to host tissue cells and transplanted cells to regulate their activation, multiplication and differentiation. New imaging tools allow the molecular-level interactions of cell receptors and signaling molecules in the 3D materials to be quantified, which promises to lead to more rationale, and less empirical design of biomaterials in the future. These microenvironments can promote angiogenesis on demand, peripheral nerve regeneration, and highly efficient repopulation of damaged tissues by transplanted progenitor cells.

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