

Materials for Angiogenesis on Demand

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Angiogenesis is a critical aspect of virtually all efforts to engineer or regenerate tissues. However, most attempts to promote angiogenesis go directly from angiogenic molecule or cell discovery to therapy, with little attention to the quantitative biology and engineering aspects of this challenge. The complex interplay of multiple factors and cells that regulate this process suggests that spatiotemporal control over their presentation will be essential to regulate the formation and function of a new vasculature. Polymeric systems that can program transplanted or host cells by providing combinations or sequences of factors in a spatially regulated manner via direct protein delivery or localized gene therapy have been developed, and demonstrated to allow one to intervene at multiple steps in a regeneration process. The power of this approach to locally regulate angiogenesis will be described, as well as the array of potential applications resulting from this approach, which include enhancing the perfusion of ischemic tissues, promoting bone and neural regeneration, and increasing tissue formation by transplanted progenitor cells.