Poly-L-Arginine Based Materials As Instructive Substrates for Fibroblasts Synthesis of Collagen

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The properties of substrates in the extracellular microenvironment affect cells and are key factors in controlling cellular behavior and responses.[1] Implanted biomaterials, tissue engineering constructs, and artificial organs all interact to some extent with surrounding tissues and cells. Ultimately, their *in vivo* fate depends on the outcome of this interaction. The impact of biomaterials on cells has been widely studied;[2–5] however, the ability to tune the response of fibroblasts for applications in wound healing and tissue engineering, in particular the substrates ability to alter the angle of collagen deposition through changing chemical functional group alone has not been explored.

The library of materials used here is based on the basic amino acid arginine. Arginine-rich peptides have been extensively explored as intracellular delivery vehicles as their guanidine functionality allow them to interact with the phosphate groups in cell membranes.[16–18] Thus, we have developed a library based on arginine on the premise that interactions between the arginine moieties and the cell membrane may result in altered cell morphology, cytokine production, and collagen fiber deposition angles by fibroblasts.

In this work, the ability to tune the fibroblast cell response in particular was examined by measuring cell morphology, cytokine production, and collagen fiber deposition angles in response to a library of arginine-based materials. The data presented here shows large variation of VEGF secretion (~600 ng/mL to 3200 ng/mL), collagen fiber orientation ($0.003 <$ polarization anisotropy <0.3357), cell migration ($\sim15 <$ persistence time < 120 min, $0.11 <$ speed < 0.23 μm/min), and cell morphology ($0.0387 <$ form factor < 0.1072). These findings demonstrate important progress in the ability to control cellular responses through biomaterials and the potential to attain the desired outcome with exposure to these materials in wound healing and tissue engineering.

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