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Light activated cell migration in synthetic extracellular matrices

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Synthetic extracellular matrices provide a framework in which cells can be exposed to defined physical and biological cues, however no method exists today to manipulate single cells within these matrices to understand fundamental principles of cell migration and define conditions that support or inhibit cell movement. Here, we present a strategy for manipulating individual mammalian stem cells in defined synthetic hydrogels through selective optical activation of Rac. A visible laser was applied to guide directional migration of mammalian stem cells in poly(ethylene glycol), PEG, based hydrogel networks incorporated with an adhesion peptide ligand, Tyr-Arg-Gly-Asp-Ser (YRGDS). Mesenchymal stem cells (MSCs) were transfected with a genetically encoded photoactivatable Rac1 (PA-Rac). Rac is a subfamily of Rho GTPases that plays a pivotal role in cell migration by stimulating actin polymerization. On exposure to visible light locally in defined regions of the cell, subcellular activation of the PARac occurs. The locally augmented Rac activation then stimulates migration of the cell towards the light. Repeated application of the light promotes continuous cell migration. Photoactivated cell migration in synthetic hydrogels depended on mechanical and biological cues in the biomaterial. Real-time hydrogel photodegradation was employed to create geometrically defined channels and spaces in which cells could be photoactivated to migrate. Cell migration speed was significantly higher in the photo-etched channels and cells could easily change direction of movement compared to the bulk hydrogels.

Biography

Qiongyu Guo has completed her Ph.D. at the age of 27 years from Case Western Reserve University. She is a postdoc fellow of Biomedical Engineering Department of Johns Hopkins University. She has published 8 papers in reputed journals.

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