Spatial and Temporal Regulation of Cellular Morphology using a Photo-Responsive Mechanical DNA Polymer

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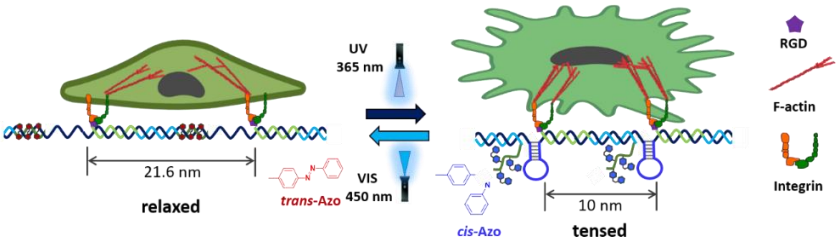
Extracellular matrix is the non-cellular component in which the cells are present in tissues and organs. The extracellular matrix, residing the cells provides a dynamic and reversible environment for the cells. These spatial and temporal cues are essential for the cells especially when they are undergoing morphogenesis, repair, and differentiation. [1,2] Recapitulation of such an intricate system with reversible presentation of nanoscale cues can help us better to understand important cellular processes and can help us precisely manipulate cell function in vitro. Previously researchers have tried to develop such systems but they are either static[3] or involve strand displacement reactions which limits their usage over several cycles and can be laborious. [4]

Herein, using principles of DNA Nanotechnology we designed a light powered DNA nanostructure containing azobenzene moieties[5] that can dynamically and reversibly cause the change in the spatial orientation of the cell adhesion peptides (RGD). The changes in the nanoscale distance of the adhesion peptides can significantly affect the morphology of the cells from a well spread state (when nanostructure is in the contracted form i.e. when RGD are closer to each other) to a less spread state (when nanostructure is in extended form i.e when RGD are farther apart) and allow us to study cell- matrix adhesion, organization of cell surface receptors etc and thus provide us a tool to decipher the language of the extracellular matrix better.

Keywords: azobenzene, cellular morphology, nanoscale cues, DNA Nanotechnology



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