

Engineering cell surfaces via liposome fusion to direct complex tissue assembly

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Proper cell-cell communication through physical contact is crucial for a range of fundamental biological processes including, cell proliferation, migration, differentiation, and apoptosis and for the correct function of organs and other multicellular tissues. The spatial and temporal arrangements of these cellular interactions in vivo are dynamic and lead to higher-order function that is extremely difficult to recapitulate in vitro. The development of three-dimensional (3D), in vitro model systems to investigate these complex, in vivo interconnectivities would generate novel methods to study the biochemical signaling of these processes, as well as provide platforms for tissue engineering technologies. Herein, we develop and employ a strategy to induce specific and stable cell-cell contacts in 3D through chemoselective cell-surface engineering based on liposome delivery and fusion to display bio-orthogonal functional groups from cell membranes. This strategy uses liposome fusion for the delivery of ketone or oxyamine groups to different populations of cells for subsequent cell assembly via oxime ligation. We demonstrate how this method can be used for several applications including, the delivery of reagents to cells for fluorescent labeling and cell-surface engineering, the formation of small, 3D spheroid cell assemblies, and the generation of large and dense, 3D multilayered tissue-like structures for tissue engineering applications.

Biography

Muhammad N Yousaf is an Assistant Professor in the department of chemistry at the University of North Carolina at Chapel Hill, USA. He earned his PhD at the University of Chicago in Chemistry and did a postdoctoral fellowship at Harvard University in the department of Cell Biology. He has published over 50 papers and book chapters and serves as an expert reviewer for many journals and funding agencies. He is on the editorial boards of the journal of biointerphases, journal of biochips and tissue chips and consults for several biotechnological companies in the area of surface chemistry, biosurfaces material science and cell biology. He has received several awards including the Damon Runyon Postdoctoral Fellowship. The Burroughs Wellcome Interface Career Award and the National Science Foundation Career Award.

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