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Light Mediated, Nanoplasmonic Gene Delivery System for Modulating Adipose Derived Stromal/Stem Cell Differentiation

Modulation of gene expression with miRNA is a promising technique for improving control of wound healing and tissue repair processes. MiRNA's utilized in autologous, adipose derived mesenchymal stem cells (ASC) are an attractive therapeutic modality for regenerative medicine. Directing the osteogenic differentiation of ASC is of particular interest in the design of therapies for critical size bone defects, spinal fusion and skeletal reconstruction. MiR-148b has been shown to induce de novo osteogenesis as indicated by increases in total alkaline phosphatase activity and early specific biomarker expression. Here we demonstrate light Activated miRNA Delivery (LAMd) system comprising plasmonic particles with light sensitive miRNA payload that can serve as a potential improvement over state-of-the-art regenerative medicine techniques by providing greater temporal and spatial control over the activation of differentiation and tissue repair.

Bio: Dr. Hayes, a graduate of the Penn State Engineering Science and Mechanics program, is currently an assistant professor in Biological Engineering at Louisiana State University. Prior to joining the faculty at LSU Dan was the co-founder of NanoHorizons Inc. a successful Penn State University spin-out, which has licensed a broad suite of intellectual property related to micro and nanofabrication from Penn State University. NanoHorizons, is a leading supplier nanoscale bioactive materials for the medical device and military community. Leveraging this experience as a tech entrepreneur he founded the LSU Engineering Entrepreneurship program, a twelve-credit program for undergraduate and graduate students teaching lab to market, technology and business development skills. His research interests include nanoscale drug/diagnostic delivery and development of materials and processes for regenerative medicine. Dan has authored numerous peer-reviewed publications and is an inventor on ~15 pending and allowed patents. Additionally, he is a recent recipient of the NSF CAREER award for his work in nanoplasmonic mediated gene delivery systems.