Biominerals for therapeutic mRNA delivery

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ABSTRACT
Despite their high regenerative potential, musculoskeletal tissues cannot heal spontaneously if the defects have critically large size. This is a significant clinical problem, as there are millions of grafting procedures performed worldwide every year. Transplantation of autologous or allogeneic tissues has been limited by supply and safety concerns, and synthetic alternatives to transplantation still show inferior performance. Our recent studies combine two emerging regenerative strategies that hold broad promise for clinical regenerative medicine: i) the use of patient derived cells and tissues, and ii) activation of patient-derived tissues with therapeutic mRNA. Our approach has involved delivering mRNA to autologous cells or tissues and thereby “engineering” the tissue regeneration process. The fundamentals of this approach could provide a path toward clinical translation, as the effectors of tissue regeneration are patient-derived, and the mRNA biologics are transient and traceless. This talk will describe our recent progress using mRNA delivery in the context of skin wound healing, skeletal tissue regeneration, and spinal cord regeneration.

BIO
William L. Murphy is the Harvey D. Spangler Professor of Biomedical Engineering, professor of orthopedics & rehabilitation, and director of the Forward BIO Institute at the University of Wisconsin. He has invented and developed multiple new classes of biomimetic materials inspired by the materials found in nature. Dr. Murphy’s research group has used new biomaterials to manufacture medical devices, human cells, and human tissues. These products are now being applied to emerging applications in tissue engineering. He has published more than 180 scientific manuscripts, 10 book chapters, and two books, filed over 50 patents, and co-founded multiple start-up companies. He has received multiple awards, including the National Science Foundation Career Award, the Wisconsin Vilas Associate Award, the H.I. Romnes Faculty Fellowship, induction into the National Academy of Inventors, and induction as a fellow in the American Institute for Medical and Biological Engineering.