

**TITLE**

**Nanoparticles for Protein delivery: Improving efficacy, reducing Protein diffusion, and reducing tissue overgrowth**

**Esmail Jabbari**

University of South Carolina, USA

Proteins play a major role in initiating the cascade of cell differentiation and maturation in regenerative medicine. However, high doses of the exogenous protein coupled with its diffusion away from the site of regeneration cause adverse side effects. In particular, recombinant human bone morphogenetic protein-2 (BMP2) used clinically in spine fusion, plays a major role in initiating the cascade of chemotaxis, differentiation of bone marrow mesenchymal stem cells (MSCs) and bone regeneration. However, high doses coupled with protein diffusion cause adverse effects such as bone overgrowth, immunological reaction, and tumorigenesis. In an effort to reduce the protein dose, diffusion, and side effects, our laboratory has pioneered to use of nanotechnology, specifically nanoparticles (NPs), for more efficient delivery of growth factors. In this approach, the protein or the amino acid sequence based on the active domain of the protein is grafted to NPs prior to applying to the regeneration site. The grafting to NPs reduces the diffusion of the protein away from the regeneration site, provides a source for sustained release of the protein in the case of biodegradable, and provides a multivalent form of the protein for stronger interaction with cell surface receptors, leading to longer-term and more efficient protein delivery with fewer side effects. We will demonstrate that the expression of differentiation markers of MSCs supplemented with BMP2 grafted NPs is significantly higher than those directly treated with BMP2. We believe this is related to a more effective presentation of the protein to clustered cell surface receptors.

**Biography**

Esmail Jabbari completed his PhD in 1993 from Purdue University and postdoctoral studies from Monsanto Corp., Rice University, and Mayo Clinic. He is the Director of Biomimetic Materials and Tissue Engineering Laboratory and Associate Professor of Chemical and Biomedical Engineering at University of South Carolina. He received the Berton Rahn Award in Orthopedic Research from the AO Foundation in 2012 and the Stephen Milam Award in Maxillofacial Research from the Oral and Maxillofacial Surgery Foundation in 2008. He has published >130 peer-reviewed papers, edited a book, and authored 10 book chapters and has given >180 lectures at international conferences.