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Presentation Title: Nuclear Mechanobiology: Why it matters to Musculoskeletal Repair

Abstract:

Degeneration in musculoskeletal tissues alters the tissue biophysical environment, including changes in extracellular matrix organization and tissue stiffness. Microscale changes in tissue environment are translated to changes in cell phenotype that may promote the onset and progression of dieses, yet the mechanisms behind how these phenotypic changes occur are poorly understood. Our resent study indicates that physiologic chemo-mechanical cues can directly regulate chromatin architecture in progenitor cell populations. We also demonstrate that soft environmental cues drive chromatin relocalization to the nuclear boundary and compaction. Conversely, dynamic stiffening attenuates these changes. Interestingly, in diseased human fibrous tissue cells, this link between mechanical inputs and chromatin nano-scale remodeling is abrogated. These data indicate that chromatin dynamics and plasticity may be hallmarks of disease progression and targets for therapeutic intervention. The mechano-epigenetic information obtained from our studies will ultimately aid diagnosis and guide development of physical therapy protocols to impact tissue repair and regeneration.

Brief Biosketch:

Dr. Heo is an Assistant Professor of Orthopaedic Surgery at the University of Pennsylvania (UPENN). He obtained his undergraduate degree and master's degree in Biomedical Engineering at Inje University under the direction of Dr. Jung-Woog Shin. He completed his Ph.D. in Bioengineering at UPENN under the direction of Dr. Robert Mauck (2015). After his Postdoctoral research and Research associate periods working with Drs. Jason Burdick, Melike Lakadamyali, and Robert Mauck, he joined the McKay Orthopaedic Research Laboratory (2020) as a faculty at UPENN where his lab (The Heo Lab) has focused on nuclear mechanobiology and tissue engineering to develop new therapeutic strategies for musculoskeletal repair and regeneration.