Stephenson School of Biomedical Engineering Seminar Series Presents

Designing Mineral Based Therapeutics to Control and Direct Cell Function

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1:30 PM
Carson Engineering Center, Room 100

Dr. Akhilesh K. Gaharwar is an assistant professor in the Department of Biomedical Engineering at Texas A&M University. He received his Ph.D. in Biomedical Engineering from Purdue University in 2011 and completed his postdoctoral training from Massachusetts Institute of Technology (MIT) and Harvard University. The goal of his lab is to understand the cell-nanomaterials interactions and to develop nanoengineered strategies for modulating stem cell behavior for repair and regeneration of damaged tissue. In particular, his lab is leveraging principles from materials science, stem cell biology, additive biomanufacturing and high throughput genomics to design nanoengineered biomaterials, with wide-ranging applications in the field of regenerative medicine. His lab has developed approaches to direct stem cells differentiation by modulating the biophysical and biochemical characteristics of nanoengineered biomaterials.

Minerals, inorganic elements, play vital roles in vivo, working synergistically with vitamins, enzymes, hormones and other nutrient cofactors to regulate the body's biological functions. However, the effect of mineral ions on cellular signaling mechanism are not known. Gaharwar's lab aims to evaluate the therapeutic effect of mineral ions and develop mineral-based nanoparticles for regenerative medicine. Our approach combines principles from materials science, stem cell biology, and high throughput genomics to understand the concepts of mineral-induced cellular signaling. In this talk, I will focus on investigating the interactions between new class of 2D mineral nanoparticles and human mesenchymal stem cells (hMSCs) at the whole transcriptome level by high-throughput sequencing (RNA-seq). Analysis of cell-nanosilicate interactions by monitoring change in transcriptome profile uncovers key biophysical and biochemical cellular pathways triggered by nanosilicates. A widespread alteration of genes is observed due to nanosilicate exposure as more than 4,000 genes are differentially expressed. This study provides novel transcriptomic insight on the role of surface-mediated cellular signaling triggered by nanomaterials and enables development of nanomaterials-based therapeutics for regenerative medicine. This approach in understanding nanomaterial-cell interactions, illustrates how change in transcriptomic profile can predict downstream effects following nanomaterial treatment.

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