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Engineering Opportunity

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Dr. Mariah Hahn
Professor
Biomedical Engineering
Rensselaer Polytechnic Institute

Friday, January 25, 2019
2:30 p.m. Presentation

Location: University at Albany, Lecture Center 20

A Bioengineered Osteoarthritis Model with Tunable Inflammatory Environments Reveals Context-dependent Therapeutic Potential of Human Mesenchymal Stem Cells

Recently, intra-articular injections of mesenchymal stem cells (MSCs) have been used as a treatment for early osteoarthritis (OA) due to the known immunomodulatory effects of these cells. However, MSC therapy has shown variable clinical outcomes. This variability in efficacy likely reflects the interplay of a range of factors which influence MSC immunoregulatory capacity. In particular, joint inflammatory state has been hypothesized to impact MSC treatment efficacy due to the known dependence of the anti-inflammatory MSC phenotype on the availability of pro-inflammatory cytokines in the surrounding environment. To gain further insight into the potential role of joint inflammatory state on MSC immunomodulatory effects, we first expanded a previously validated 3D in vitro model of inflammatory OA to allow for tunable inflammatory conditions. We then utilized our expanded in vitro OA model to assess the therapeutic potential of MSCs in “high” (High-OA) versus “low” (Low-OA) inflammatory contexts. Addition of MSCs to High-OA conditions stimulated significantly lower production of IL-1β, IFN-γ, MMP-9, and MMP-13

by osteoarthritic chondrocytes (OACs) and reduced macrophage activation. In contrast, addition of MSCs to Low-OA conditions increased OAC expression of OA-related markers IL-6 and IL-8 and induced a wound healing-like phenotype in macrophages. Based on these results, we then assessed if MSCs primed with pro-inflammatory factors IFN-g and TNF-α could improve MSC treatment efficacy in Low-OA conditions. No improvements in MSC anti-inflammatory effects were observed for Low-OA after priming. These findings suggest a key role for the inflammatory environment and MSC "activation" state in determining MSC immunomodulatory effects.

Speaker's Bio: Mariah Hahn received her Bachelor of Science degree in chemical engineering in 1998 from the University of Texas, from which she graduated with highest honors. She continued her education at Stanford, where she received a Masters degree in electrical engineering in 2001. She completed her PhD studies in vocal fold regeneration at the Massachusetts Institute of Technology in 2004. During her PhD and post-doctoral studies, Dr. Hahn was trained by two leaders in tissue engineering and biomaterials - Dr. Robert Langer and Dr. Jennifer West. In 2005, Dr. Hahn joined the department of chemical engineering at Texas A&M University, College Station, as an assistant professor and was promoted to associate professor in 2011. She joined Rensselaer Polytechnic Institute as an associate professor of biomedical engineering in 2012 and was promoted to full professor in 2016. Her research interests include tissue engineered disease models. Dr. Hahn is a recipient of the NSF CAREER Award (2010), the American Heart Association Scientist Development Award (2008), and the American Society of Engineering Education GSW Young Faculty Award (2009). Prof. Hahn was elected to the College of Fellows of the American Institute of Medical and Biological Engineering (AIMBE) for her contributions to the field of tissue engineering and biomaterials.

For more information, contact the college at ceasinfo@albany.edu or 518-956-8240.