Amgen Seminar Series in Chemical Engineering

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Electromagnetically Inspired Approaches in Biomaterials and Drug Delivery

By

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The ability to spatially and temporally regulate the delivery of therapeutic biomolecules *in vivo* is pervasively desired in contemporary and emerging biotechnological and therapeutic contexts. That is, because biology varies greatly in space and time, the medical community requires biomaterials and biosystems that can communicate/direct biology with a high degree of spatial and temporal precision. The ability to regulate the timing, dose, and directionality of multiple biomolecules is particularly desirable in the realm of tissue engineering, where the engineering/repair of functional tissues requires a highly choreographed sequence of localized biomolecular presentations. Here, I will describe works in progress towards the development of biomaterial systems—using simple electromagnetic principles as inspiration—that are capable of releasing molecular payloads in response to externally administered stimuli. I will describe how these systems may provide a high degree of control over the timing, dose, and directionality of multiple biomolecular presentations in wound healing and tissue engineering applications. I will also describe additional research directions geared towards directing biological processes that foundationally involve the use of electromagnetic principles. These projects will aim to (i) endow implant materials with bio-mimetic and bio-instructive properties, (ii) spatiotemporally regulate gene and drug delivery across cell membranes, and (iii) molecularly target undesirable cells for destruction.

Bio:

Dr. Kennedy is currently an Assistant Professor of Biomedical and Chemical Engineering at the University of Rhode Island. Prof. Kennedy is coming to Rhode Island from the Laboratory for Cell and Tissue Engineering at Harvard University's School of Engineering and Applied Sciences and the Wyss Institute for Biologically Inspired Engineering. He received his Ph.D. in electrical engineering from the University of Wisconsin in 2010 with concentrations in applied electromagnetics, cellular and molecular biology, and stem cell bioengineering. During his postgraduate training, Prof. Kennedy was awarded a National Institutes of Health Ruth L. Kirschstein Predoctoral Fellowship and a University of Wisconsin Stem Cell and Regenerative Medicine Faculty Fellowship in Interdisciplinary Bioengineering in order to investigate the use of micro-environmental charge for enhancing targeted gene and drug delivery. His current and future research endeavors involve the exploitation of fundamental electromagnetic principles in the areas of biomaterials development, controlled drug delivery, wound healing, and tissue engineering. His scientific works have been recognized three times by the Bioelectromagnetics Society and have been published in 27 peer-reviewed articles and conference papers. In 2008, he was awarded the University of Wisconsin's Gerald Holdridge Award for Excellence in Teaching and the National Institutes of Health's National Research Service Award. He is originally from Huntsville, Alabama and currently resides in West Warwick with his wife, Sandra, and dog, Doodles.

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