PennState College of Engineering | BIOMEDICAL ENGINEERING

Seminar Series

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Auburn University

Zoom link:
https://psu.zoom.us/j/93905661042?pwd=UGtqSXRjRE5ra1VUN2xBdVV4clFoUT09

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310707

Engineered tissue microspheres for regenerative medicine and disease modeling applications

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ABSTRACT

Dr. Lipke's research group employs biomimetic materials to guide induced pluripotent stem cell differentiation and maturation, particularly for the scalable production of human heart tissue, to support therapeutic cell delivery, and to create engineered cancer tissues that recapitulate key aspects of the tumor microenvironment. Most recently, we have established a rapid and readily replicable approach to encapsulate cells in poly(ethylene glycol)-fibrinogen (PEG-Fb) microspheres for a range of applications, including stem cell differentiation, cancer tissue engineering, tissue spheroid based drug-testing assays, and injectable therapeutic cell delivery. Using a microfluidic approach, hydrogel microspheres with uniform shape and size can be produced with high (20 million cells/mL) cell densities. A range of cell types, including stem and progenitor cells and cancer cells, have been encapsulated. By providing a tunable, biomimetic cellular microenvironment, these hydrogel microspheres have been shown to support stem cell proliferation and differentiation, including cardiac differentiation of human induced pluripotent stem cells. The established hydrogel microsphere system also can be employed for encapsulation and delivery of therapeutic cell types; fabricated microspheres supported maintenance of encapsulated endothelial progenitor cell phenotype and outgrowth in vitro and in vivo delivery through injection in an equine wound healing model. Encapsulated cancer cells also remodeled the PEG-Fb and formed dense tissues over time; engineered tumor spheroids were more uniform than spontaneously aggregated cancer cells and could be maintained for multiple weeks in culture. Overall, rapid and reproducible cell encapsulation in hydrogel microspheres has advantages for use in regenerative medicine and disease modeling applications.

BIO

Dr. Elizabeth Lipke is the Mary and John H. Sanders Professor in the Department of Chemical Engineering at Auburn University. Dr. Lipke completed her graduate studies at Rice University followed by a postdoctoral fellowship at Johns Hopkins University. Dr. Lipke's research focuses on the use of cell-material interactions to create cellular microenvironments that guide tissue formation and direct cellular function. To advance cardiac regeneration, Dr. Lipke's research group employs biomimetic materials to direct pluripotent stem cell differentiation and create 3D developing human engineered cardiac tissues; this platform for ontomimetic differentiation has been recently shown to also support in vitro cardiac tissue maturation, including T-tubule formation. For use in suspension-based cell production and injectable cell therapy, Dr. Lipke's research group has established a platform for fabricating injectable, cell-laden hydrogel microspheres. In their cancer research, the Lipke lab has created spheroidal and microfluidic chip-based tissue-engineered tumor models that recapitulate key native tumor characteristics for improved drug testing. In recognition of her research, Dr. Lipke has received several national awards including a National Science Foundation CAREER award, a 3M Nontenured Faculty Award, and an American Heart Association Scientist Development Grant. In addition to the recognition of her research accomplishments, Dr. Lipke has received awards for teaching and mentoring of undergraduate and graduate students.