

ENGINEERING SEMINAR

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ENGINEERING MUCUS AND INNATE LUNG DEFENSE

Gregg Duncan earned his Ph.D. in chemical engineering under the guidance of Michael Bevan at Johns Hopkins University in 2014. He then completed his postdoctoral training at Johns Hopkins School of Medicine in the Center for Nanomedicine directed by Justin Hanes. Dr. Duncan is currently an Associate Professor in the Fischell Department of Bioengineering at the University of Maryland. He is the recipient of several honors and awards including the BMES Rita Schaffer Young Investigator Award, the CMBE Young Innovator Award, and the NSF CAREER Award.

Mucus is a biological gel within the lung designed to behave like an “escalator” with the ability to capture potentially harmful inhaled materials (e.g. pathogens, particulates) and carry these materials via mucociliary clearance up to the throat to be swallowed and sterilized. However due to the lack of appropriate models, it is unclear how the physical and biochemical properties of mucus collectively dictate its function. Recently, we have engineered a mucin-based biomaterial with native-like viscoelasticity, here termed ‘synthetic mucus’. I will discuss how we have used synthetic mucus biomaterials to understand how the biochemical and biophysical features of airway mucus impact its function in health and dysfunction in diseases such as asthma and cystic fibrosis. In addition, I will discuss a genetically engineered human airway tissue culture model developed in our lab to study how mucus transport is dynamically controlled based on mucin glycoprotein composition. Finally, I will share our efforts to target airway obstruction to treat asthma using mucin-targeted gene therapy.

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