

## ANALYTICAL SEMINAR

### *Understanding, Engineering, and Predicting the Interaction of Nanomaterials with Biological Systems*

The small size of nanomaterials, similar to proteins and organelles, allows them to interact in unique ways with biological systems. The ability of scientists to control the composition, size, shape, and surface properties of nanomaterials provides a method to control this interaction. The Payne Lab at Duke University is working to understand how nanomaterials interact with proteins and cells. This talk will discuss three overlapping projects to highlight this work. First, we examine how cells and mice respond to TiO<sub>2</sub> nanoparticles that are used industrially in pigments and food coloring. These nanoparticles can be inhaled in the manufacturing environment. By understanding the chemical and physical properties of the TiO<sub>2</sub> nanoparticles, we can understand which specific properties lead to an observed pro-inflammatory response, which may provide pathways for mitigation. Second, moving forward, we hope to predict the in vitro and in vivo response to nanomaterials rather than relying on extensive experiments like those described for TiO<sub>2</sub> nanoparticles. A key step is to predict the proteins that adsorb on the surface of nanomaterials when they encounter a biological fluid such as blood or lung fluid. We are using lab automation and machine learning to create a library of protein-nanoparticle interactions to then predict biological outcomes based on nanoparticle characteristics. Third, we can use synthetic nanoparticles with well-controlled chemical and physical properties as a model system to understand biological nanoparticles produced by cells. This talk will discuss one example of our work using nanoparticles to better understand autoimmune diseases such as lupus. Overall, we hope all of these projects will provide a better understanding of how nanomaterials interact with biological systems.



**CHRISTINE PAYNE Ph.D**

**DUKE UNIVERSITY**

**MONDAY**

**FEBRUARY 3RD, 2025 @4:00**

**219 BRL**

Prof. Christine Payne is the Yoh Family Professor and Donald M. Alstadt Chair of Mechanical Engineering and Materials Science at Duke University. Her research focuses on understanding how cells interact with nanomaterials. Her lab uses advanced fluorescence microscopy approaches to image this interaction and lab automation to increase throughput and reproducibility. Dr. Payne has received many honors including an NIH Director's New Innovator Award in 2009 and a DARPA Young Faculty Award in 2011. She is a Fellow of the Royal Society of Chemistry. She earned a B.S. in Chemistry from the University of Chicago (1998) and a Ph.D. in Chemistry from the University of California, Berkeley (2003). Prof. Payne spent 2003-2006 as an NIH NRSA Postdoctoral Fellow at Harvard University. She joined the faculty of the School of Chemistry and Biochemistry at Georgia Tech in 2007 and moved to Duke University in 2018. She served as a Jefferson Science Fellow with the U.S. Department of State in 2024.



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