Geoffrey D. Bothun

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Dr. Geoff Bothun is a Professor of Chemical Engineering at the University of Rhode Island and Principal Investigator and Project Director of the Rhode Island National Science Foundation Track-1 EPSCoR award. His research is in the area of bionanotechnology, utilizing colloidal and interfacial science, self-assembly, and lipid biophysics to design nanotheranostic materials, examine nanotechnology environmental health and safety, and create nanomaterials for environmental applications.

Dr. Bothun received undergraduate degrees in chemical engineering and chemistry from the University of Nevada in Reno, and his PhD in chemical engineering from the University of Kentucky. Prior to joining URI in 2006, Dr. Bothun was an NSF Discovery Corps postdoctoral fellow at North Carolina A&T State University working with the NSF Science and Technology Center for Environmentally Responsible Solvents and Processes.

Polyelectrolyte-modified soft and hard templates for environmental and biomedical nanomaterial synthesis

Abstract

One of the goals in our group is to create and utilize versatile templating techniques to design nanomaterials that address emerging environmental and biomedical needs. A simple way to modify the surface properties of a soft or hard material is through polyelectrolyte deposition. This process, driven by enthalpic and entropic interactions, creates a surface layer that reflects the charge density of the polyelectrolyte. We use polyelectrolyte deposition to modify lipid bilayer vesicles or liposomes (soft) and fractal carbon black nanoparticles (hard) in order to create templates that guide the synthesis of gold nanoshells. By tuning the surface properties and synthesis conditions, we are able to obtain a variety of heterogeneous gold nanoshell structures from discontinuous to “spiky” with distinct optical properties. When templating with liposomes, which are soft nanoscale capsules with internal aqueous reservoirs, multifunctional colloids are created containing encapsulated iron oxide nanoparticles that can be activated thermally using near-infrared and alternating current electromagnetic fields. With these active triggers, it is possible to control drug release and thermal treatment (hyperthermia) in cell cultures through external stimuli. When templating with fractal carbon black particles, colloidal structures are created that are capable of capturing environmental pollutants and detecting them in situ using surface enhanced Raman spectroscopy (SERS). These structures could also be embedded in nanostructured carbon filter paper, providing a robust solid platform for field application.

Thursday Nov. 15th, 2018
368 Ritchie Hall | 11:00 – 11:50AM