

Mechanical Engineering Seminar Series

April 24, 2025, 11:00AM

E-203E, Dean's Conference Room

**Title: Complex Metal Nanostructures
in Biomedical Applications from Diagnosis to Treatment**

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Abstract: Complex metal nanostructures represent a remarkable class of materials with distinctive physicochemical properties. Nanostructures exhibiting shape anisotropies—such as nanorods, nanocages, and nanoprisms—are particularly appealing due to their highly tunable plasmon resonances, making them valuable for diverse applications. In recent years, these unique properties have driven the development of novel nanostructures with varied compositions, enabling biomedical applications like targeted imaging, catalytic therapy, and cancer treatment. This research focuses on designing solution-based, seed-mediated synthetic protocols to create plasmonic nanostructures—including hollow nanoshells, nanoboxes, and nanocages—for use in sensing, imaging, and anti-biofilm platforms. The resulting nanoparticles serve as contrast agents for biomedical imaging techniques such as computed tomography (CT). Additionally, their optical properties make them effective in photoacoustic imaging (PA) and photothermal therapy (PTT). This work also introduces an innovative nanoparticle-based strategy for detecting and treating harmful biofilms. The presentation will conclude with an overview of ongoing research on bacteriophage-nanoparticle conjugates, aimed at developing theranostic agents capable of imaging virulent biofilms and treating infectious diseases with precise spatial control in a short timeframe.

Bio: Dr. Maryam Hajfathalian is an Assistant Professor of Biomedical Engineering at NJIT, whose research focuses on the development, synthesis, and characterization of theranostic nanomaterials. These materials target the delivery of nanoagents to specific cells or tissues, aiding in the detection and treatment of cancer and infectious diseases. Before joining NJIT, Dr. Hajfathalian was a postdoctoral research scholar at the School of Medicine at Stanford University, Division of Infectious Diseases, and the University of Pennsylvania, Radiology Department, under the mentorship of Professors Paul Bollyky and David Cormode. Her achievements include receiving an NIH NIBIB K99/R00 Pathway to Independence Award, a Stanford Woods Institute for the Environment Grant, and various recognitions such as a WIMIN Leadership Award, Science Slam Presentation Award, and the WIMIN Scholar Award in World Molecular Imaging Conferences. She is dedicated to promoting diversity and inclusion in academia and industry, viewing teaching, and mentoring as vital opportunities to support the educational goals and personal growth of females and underrepresented minorities.

