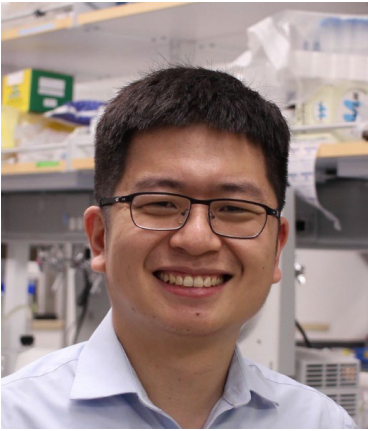# University of Houston - Biomedical Engineering Seminar
Friday, March 28, 2025 at 12 noon, Room: Science 105

George Lu, Ph.D.

Air-filled Protein Organelles: Assembly, Biophysics, and Biotechnological Applications

Abstract

Gas vesicles are a class of air-filled protein organelles found in photosynthetic microbes, which use them as intracellular flotation devices. Their 3-nm-thick, rigid protein shells can withstand tens of atmospheres of pressure, making them both more stable and smaller than conventional lipid-encapsulated bubbles. As such, gas vesicles represent a remarkable class of nanomaterials evolved by nature. In this talk, we will first explore how to leverage their unique material properties for various biotechnological applications. This includes our recent work, in which we have further shrunk them down to the size of a virus, creating some of the smallest free-floating 'bubbles' ever made and enabling ultrasound access to lymph-node-resident cells. Notably, developing such applications relies on a fundamental understanding of gas vesicle biophysics. To this end, we will discuss our recent progress in elucidating how a set of 10 accessory proteins cooperates in the assembly process and how phase-separable proteins govern the spatial organization of these microbial organelles. By investigating the fundamental biophysics underlying gas vesicle biogenesis, we aim to fully unlock their potential for transformative biomedical and synthetic biology innovations.

Biosketch

George Lu is an Assistant Professor in the Departments of Bioengineering and Biosciences at Rice University. He earned his Ph.D. in protein biochemistry from UC San Diego and conducted postdoctoral research in the Shapiro Lab in the Department of Chemical Engineering at Caltech. At Rice, he launched an independent lab that applies synthetic biology and protein engineering to explore the biophysics of gas-filled protein nanostructures and develop innovative applications in living materials, biomanufacturing, ultrasound imaging, and beyond. His lab is supported by the NIH, NSF, DARPA, and CPRIT, as well as private foundations such as Welch, Mathers, and John Dunn. Website: https://lulab.rice.edu