Department of Biomedical Engineering
UNIVERSITY OF WISCONSIN–MADISON
Celebrating 25 Years

Spring 2025 Seminar Series

Engineering multistate trackable cells for smart precision therapeutics

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The engineering of immune cells and microbes into living therapeutics is emerging as a powerful approach for treating many diseases. However, two key challenges must be addressed to unlock the full potential of living therapeutics: intricately programming cells to perform diverse therapeutic tasks, and effectively monitoring them once administered to the body. My research provides the foundation to address these major challenges. In my presentation, I will outline how cells can be engineered to differentiate into multistate communities with distributed functions, using Synthetic Differentiation circuits. The biomolecular mechanism of Synthetic Differentiation circuits can be engineered to tune the community composition, expand the number of unique states, and replenish population imbalances in the community. I will highlight examples demonstrating the versatility of these circuits in applications spanning living therapeutics and agricultural biotechnology. Additionally, I will demonstrate noninvasive methods for tracking the location and function of cells deep in the body. Most methods to image cells rely on light, which has limited penetration depth. Conversely, ultrasound can image deep in tissue but lacks genetic reporters. I will introduce the first acoustic reporter genes (ARGs)—a 'GFP' for ultrasound—that enable imaging of cells and their gene expression inside the living, intact animal. Together, these technologies will enable next-generation living therapeutics capable of simultaneously targeting many disease hallmarks while providing real-time feedback to scientists and clinicians.

ABOUT the SPEAKER

Dr. Arash Farhadi is a postdoctoral scholar with Prof. Christopher Voigt at the Massachusetts Institute of Technology. He received his PhD in Bioengineering at the California Institute of Technology under the mentorship of Prof. Mikhail Shapiro, MS in Medical Biophysics from the University of Toronto, and his BSc in Nanotechnology Engineering at the University of Waterloo. Arash's research interests lie at the interface of medical biophysics, synthetic biology, and cellular engineering. Arash is the recipient of the Natural Sciences and Engineering Research Council of Canada Scholarship and the Canadian Institutes of Health Research Scholarship. He is committed to recruiting and retaining diverse scientific talent and to creating a safe and inviting space for scientists to pursue their passions through mentoring, teaching, and service activities.

Thursday, March 6 at Noon
2180 Mechanical Engineering