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

Spring 2025 Seminar Series

Harnessing the Power of Immunometabolism to Engineer the Future of Medicine

Chima V. Maduka, DVM, PhD
AHA Postdoctoral Fellow
Burdick Biomaterials and Biofabrication Laboratory
University of Colorado

The metabolic underpinnings of immune cells in various inflamed tissues, such as the implant microenvironment or the diseased heart, are poorly understood. For instance, polylactide (PLA) is the most widely used biopolymer in medicine. Yet, for decades, PLA had been thought to activate immune cells by reducing surrounding pH because PLA biodegrades into monomers and oligomers of lactic acid. During my talk, I will discuss an alternative paradigm underscoring immune cell metabolism (immunometabolism) as the pivotal determinant of the proinflammatory versus pro-regenerative tissue microenvironment with biodegradable and non-biodegradable biomaterial examples. Further related to tissue engineering, I will present on reversing established cardiac dysfunction and fibrosis in heart failure (following myocardial infarction) via targeted and enzyme-responsive nanomaterials. Finally, I will unveil my vision to revolutionize therapeutic strategies for the various phenotypes of heart failure by leveraging the metabolic underpinnings of immune and stromal cell populations, thereby engineering next-generation clinical interventions that shape the future of medicine.

ABOUT the SPEAKER

Dr. Chima Maduka started out as a small animal veterinarian before moving into basic and translational research in biomedical engineering. During his PhD at Michigan State University, Dr. Maduka elucidated the role that immunometabolism plays in the adverse, chronic inflammation elicited by biomaterials. Accordingly, his doctoral work informed novel immunomodulatory strategies that resulted in multiple provisional patent applications and several manuscripts, including publications in Nature Biomedical Engineering, Bioactive Materials and Advanced Science. His non-traditional trajectory fuels his innovation and translational perspective. As an American Heart Association (AHA) postdoctoral fellow at the University of Colorado Boulder, Dr. Maduka works on drug delivery to the cardiopulmonary system, where he has pioneered a targeted and enzyme-responsive nanomaterial formulation that normalizes cardiac function with a 400,000-fold reduction in clinical trial doses. Dr. Maduka's work has been recognized by several awards, including a METiS Therapeutics Travel Award for the Society for Biomaterials. Dr. Maduka envisions leveraging immunometabolic and biomaterial strategies to understand and treat chronic debilitating conditions, including heart failure.

Thursday, January 16 at Noon
2188 Mechanical Engineering Building