School of Molecular Sciences
Arizona State University

SMS Fall 2023 Seminar Series

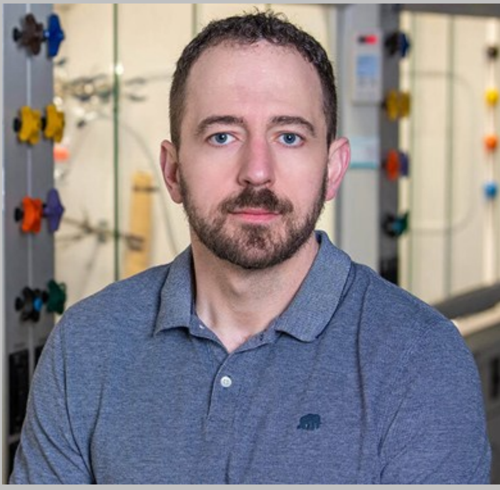
Friday Oct 13 | 3pm | Biodesign Auditorium

Designing Bio-Inspired Soft Matter through Dynamic Recognition Motifs

Nature abounds with examples of elegant structures and functions, often achieved by leveraging equilibrium-governed recognition motifs. These natural systems inspire the preparation of synthetic analogues with diverse function, to include uses as biomaterials and drug delivery devices. The nanoarchitecture of biological materials can arise from precisely engineering molecular-scale interactions, as well as through active perturbation of thermodynamic parameters to modulate the free energy landscape governing material formation. Such phenomena inspire the design of functional materials with precise nanoscale organization, as well as the use of stabilizing or destabilizing stimuli to realize responsive therapeutic function on demand. In this way, our lab has sought systems that adjust the state of associative interactions in response to biologically relevant triggers, such as glucose, in order to deliver therapeutics and address disease in real time with actively sensing material platforms. Nature similarly achieves remarkable function through high-affinity non-covalent recognition, with interactions such as biotin–avidin and antibody–antigen proving especially useful in facilitating recognition in a complex milieu. Host–guest supramolecular recognition offers a synthetic mimic of such affinity motifs. Tuning molecular-scale affinity affords an approach to control the bulk dynamics of a biomaterial, which translates to tunable release of encapsulated payloads, dictates the rate of cell infiltration, and controls the timescale of material clearance *in vivo*. Certain of these host–guest interactions are furthermore able to achieve affinities sufficient for recognition in complex or contaminated environments, and offer a new non-biological axis for drug homing and retention at desired sites in the body. As such, the ability to leverage non-covalent interactions from synthetic motifs enables aspects of natural biological materials and systems to be replicated, with specific functional utility in the delivery of therapeutics and creation of new biomaterials.

Matthew Weber

Professor, University of Notre Dame



Matthew Webber is the Keating-Crawford Collegiate Professor of Engineering and an Associate Professor in the Department of Chemical & Biomolecular Engineering at the University of Notre Dame (USA). His research group is interested in applying supramolecular principles, leveraging defined and rationally designed non-covalent interactions, to improve biomaterials and drug delivery. Prof. Webber received a BS in Chemical Engineering from the University of Notre Dame and a PhD in Biomedical Engineering from Northwestern University. Subsequently, he was an NIH NRSA postdoctoral fellow at MIT. He is the recipient of the American Diabetes Association Pathway Accelerator Award and the JDRF Career Development award, and was named by the American Institute of Chemical Engineers as one of the “35 under 35” young leaders shaping the field in 2017. He also received the NSF CAREER award in 2020 and was inducted to the College of Fellows of the American Institute of Medical and Biological Engineering in 2023.

***ZOOM option available: https://asu.zoom.us/j/81517529537**