Fall 2016 Bioengineering Seminar Series

Therapeutics Through Supramolecular Design

Matthew J. Webber, PhD, Professor, Department of Chemical and Biomolecular Engineering,
The University of Notre Dame

Abstract: Using principles from supramolecular chemistry – that is, *"chemistry beyond the molecule"* – it is possible to create systems rationally designed at the molecular level that can address complexities associated with the deficiencies and dynamics of disease. The biological relevance of peptides, and the ability to precisely engineer supramolecular interactions through directional assembly and organized hydrogen bonding, enables the generation of platforms that can be utilized as functional therapeutic materials. These bio-inspired materials interface with biology and physiology in a mimetic and active way. Self-assembling peptides can be used to present potent bioactive signals at high density to mimic the function of angiogenic growth factors, or to prepare favorable niches for stem and progenitor cell therapeutics. Molecular interactions can additionally be leveraged to alter therapeutic dynamics and afford aspects of biologically relevant sensing in molecularly engineered protein therapies. Diabetes, and the complexities associated with glycemic control, present a significant engineering constraint in the design of therapies to recapitulate and replace the dynamics of native insulin signaling. Through covalent modification of insulin with molecular recognition motifs and aliphatic groups, the kinetics of insulin activity can be modulated by glucose-mediated dynamic covalent interactions, resulting in biomimetic insulin therapy. Alternatively, precise supramolecular host-guest interactions can be used to tune both the stability and activity of a broad suite of biopharmaceuticals, including insulin. In sum, these findings point to a new era of rationally engineered therapies rooted in predictable, biomimetic, tunable, and dynamic supramolecular interactions.

Where: SSOE Seminar Room, NI 1027
When: November 4th , 2016
Time: 12:00 – 1:00 pm

Bio: Matthew Webber is an Assistant Professor in the Department of Chemical & Biomolecular Engineering at the University of Notre Dame. His research group (www.WebberLab.com) is interested in applying supramolecular principles, leveraging defined and rationally designed non-covalent interactions, to improve therapeutic practice. He is specifically curious about the possibilities for high affinity interactions to overcome barriers in drug delivery and improve biomedical device practice. Prof. Webber received a BS in Chemical Engineering from the University of Notre Dame, and MS and PhD degrees in Biomedical Engineering from Northwestern University. His dissertation, performed in the laboratory of Prof. Samuel Stupp, focused on the use supramolecular peptide assemblies for cardiovascular disease therapeutics. Subsequently, he was an NIH NRSA postdoctoral fellow in the laboratories of Prof. Robert Langer and Prof. Daniel Anderson at MIT, working on the development of new molecular engineering approaches toward the treatment of diabetes. His research passion is to contribute to bringing the field of *Supramolecular Therapeutics* into prominence. He has authored 45 peer-reviewed papers and is inventor on 5 pending or awarded patents.