

**Research Seminar Series**

**University of Nebraska-Lincoln**

**Department of Chemical and Biomolecular Engineering**

Model-Predictive Design and Optimization of Cellular Sensors, Circuits, and Pathways

**Prof. Howard Salis**

*Pennsylvania State University, Chemical Engineering and*

*Biological Engineering*

**Friday, November 4th, 2016**

3:00 p.m. – 4:15 p.m.

Othmer Hall, Room 105

*\*Refreshments provided*

**Abstract**

DNA is Nature's programming language and its sequence determines how organisms sense their environment, perform decision-making, and catalytically produce valuable chemical products. The Salis lab develops sequence-to-function biophysical models of gene regulation, and conducts thousands of systematic and quantitative experiments to validate their predictions. We combine our models with computational optimization to design non-natural genetic systems with targeted functions and capabilities. As examples, we’ve engineered hundreds of cellular sensors, genetic circuits, and metabolic pathways with optimized performances, including riboswitches that detect 2,4-dinitrotoluene, signal amplifying genetic circuits, mixed feedback control circuits for portable cross-species expression, and multi-enzymes pathways for over-production of desired cofactors and chemicals. Beyond their practical applications, these examples critically test our understanding of the physical mechanisms governing sensor, circuit, and pathway function, and our ability to automatically design sensors, circuits, and pathway with desired capabilities. Through our web-based platform (<http://salislab.net/software>), 6500 researchers have used our algorithms to design over 100,000 DNA sequences for their own commercial and non-commercial biotech applications. In this talk, we present specific models, algorithms, and experimentally validated examples that highlight how the automated design of genetic systems will continue to radically change the way we engineer biology in the future.