

# Northeastern University Distinguished Seminar Series Civil & Environmental Engineering

## Michael Shuler, Ph. D.

James M. and Marsha McCormick Chair of Biomedical Engineering  
Samuel B. Eckert Professor of Chemical Engineering

### Do We Know Enough to Reconstruct Life In-Vitro?

The question of “what is essential for life” is one of the most fundamental questions humankind faces. If we truly understand a system, we should be able to reconstruct it. We propose to construct *in silico* a model of a chemoheterotrophic bacterial cell with the minimum number of genes for indefinite growth and replication *in vitro* culture. The success of whole organism genome sequencing and high throughput measurements has provided an opportunity for system-level analysis of whole cells leading to what has been termed “systems biology.” Additionally, primitive efforts have been made to use this information to construct human designed cells as a component of what has been called synthetic biology. We believe that appropriate *in silico* models that we are developing (e.g. Minimal Cell Model or MCM) may guide such efforts. In the talk we describe our approach to constructing a cell model in which all genes are identified and almost all chemical species within the cell are tracked. We construct a dynamic modeling framework of a single cell that integrates genomic detail with cellular physiology. The MCM incorporates physiological events (e.g. initiation of chromosome replication, cell division, etc.) as well as metabolic networks, cell geometry, and cellular regulatory strategies. Such a modeling approach can provide a platform for evaluating proposed gene sets and ultimately the design of living cells for biotechnological purposes.



**Michael Shuler** is the James M. and Marsha McCormick Chair of Biomedical Engineering and Samuel B. Eckert Professor of Chemical Engineering. He does research in Biomolecular engineering, Nanobiotechnology, Molecular toxicology and pharmacology, In-vitro modeling, and Drug delivery. He has received rewards and recognition in the following: National Academy of Engineering 1989, American Academy of Arts and Sciences 1996, and Honorary Doctorate from University of Notre Dame 2008. He received his Ph.D. at the University of Minnesota and completed his undergrad at the University Of Notre Dame.

**Tuesday, December 6, 2011  
1:45 p.m. – 2:45 p.m.  
103 Churchill Hall**