

2015-16 **DISTINGUISHED**
LECTURE SERIES

10/07/15

MITCHELL HALL

3:30^{PM}

Reception in
DuPont Hall Lobby



RON WEISS

*Director, Synthetic Biology Center Professor of Biological
Engineering and Electrical Engineering and Computer Science*

Massachusetts Institute of Technology, Cambridge MA

Synthetic Biology: From Parts to Modules to Therapeutic Systems

Synthetic biology is revolutionizing how we conceptualize and approach the engineering of biological systems. Recent advances in the field are allowing us to expand beyond the construction and analysis of small gene networks towards the implementation of complex multicellular systems with a variety of applications. In this talk, I will describe our integrated computational / experimental approach to engineering complex behavior in a variety of cells, with a focus on mammalian cells. In our research, we appropriate design principles from electrical engineering and other established fields. These principles include abstraction, standardization, modularity, and computer aided design. But, we also spend considerable effort towards understanding what makes synthetic biology different from all other existing engineering disciplines and discovering new design and construction rules that are effective for this unique discipline. We will briefly describe the implementation of genetic circuits and modules with finely-tuned digital and analog behavior and the use of artificial cell-cell communication to coordinate the behavior of cell populations. The first system to be presented is a genetic circuit that can detect and destroy specific cancer cells based on the presence or absence of specific biomarkers in the cell. We will also discuss preliminary experimental results for obtaining precise spatiotemporal control over stem cell differentiation for tissue engineering applications. We will conclude by discussing

the design and preliminary results for creating an artificial tissue homeostasis system where genetically engineered stem cells maintain indefinitely a desired level of pancreatic beta cells despite attacks by the autoimmune response, relevant for diabetes.

BIOGRAPHY

Ron Weiss is Professor in the Biological Engineering and the Electrical Engineering and Computer Science Departments at MIT, and is the Director of the Synthetic Biology Center. His research focuses on synthetic biology, where he programs cell behavior by constructing and modeling biochemical and cellular computing systems. A major thrust of his work is synthesis of gene networks that are engineered to perform in vivo analog and digital logic computation. Weiss is engaged in both hands-on experimental work and in implementing software infrastructures for simulation and design work. For his work in synthetic biology, among other honors, Weiss has received MIT's Technology Review Magazine's TR100 Award ("top 100 young innovators", 2003) and was selected as a speaker for the National Academy of Engineering's Frontiers of Engineering Symposium (2003). In 2004, his research in Synthetic Biology was named by MIT's Technology Review Magazine as one of "10 emerging technologies that will change your world."

