2014 PROGRAM

8 AM REGISTRATION & CONTINENTAL BREAKFAST
Gallery, W.T. Young Library

8:45 AM WELCOME
Dr. Eli Capilouto, University of Kentucky President
Auditorium, W.T. Young Library

9 AM DR. HAO YAN
Arizona State University
Designer Architectures for Programmable Self-assembly

The central task of nanotechnology is to control motions and organize matter with nanometer precision. To achieve this, scientists have investigated a large variety of materials including inorganic materials, organic molecules, and biological polymers as well as different methods that can be sorted into so-called "bottom-up" and "top-down" approaches. Among all of the remarkable achievements made, the success of DNA self-assembly in building programmable nanopatterns has attracted broad attention. In this talk I will present our efforts in using DNA as an information-coding polymer to program and construct DNA nano-architectures with complex geometrical features. Use of designer DNA architectures as molecular sensor, actuator and scaffolds will also be discussed.

10 AM BREAK & REFRESHMENTS

10:30 AM DR. DONALD E. INGBER
Harvard University
From Cellular Mechanotransduction to Biologically Inspired Engineering

In this lecture, I will describe the fundamental role that mechanical forces play in control of cell and tissue development, as well as how this knowledge is being leveraged to engineer new bioinspired materials and devices. Living cells form and function as dynamic hierarchical assemblies of nanometer scale components, yet they exhibit great robustness, mechanical strength and biochemical efficiency. This is possible because they use 'tensegrity' architecture to mechanically stabilize their internal molecular scaffolds, which also orient most of the cell's biochemical processing machinery. This structural perspective has led to new insights into the molecular basis of cellular mechanotransduction – the process by which living cells sense mechanical forces and convert them into changes in intracellular biochemistry. It also has led to the creation of human "organ-on-a-chip" microdevices that recapitulate the complex structures and functions of living organs, which represent powerful new in vitro tools for modeling human physiology and disease.

11:30 AM LUNCH

1:30 PM POSTER SESSION
Ballroom, King Alumni House

2:30 PM DR. TODD YEATES
University of California Los Angeles
Giant Protein Cages and Assemblies in Nature and by Design

Nature has evolved myriad sophisticated structures based on the assembly of protein subunits. Many types of natural protein assemblies (such as virus capsids) have been studied extensively, while a number of equally sophisticated natural protein assemblies are only beginning to be appreciated. Among the latter group is a broad class of giant, capsid-like assemblies referred to as bacterial microcompartments. They serve as primitive metabolic organelles in many bacteria by encapsulating sequentially acting enzymes within a selectively permeable protein shell. Our laboratory has elucidated key mechanisms of these protein-based bacterial organelles through structural studies. On the engineering side, sophisticated natural protein assemblies like these have for many years represented an ultimate goal in protein design. By exploiting principles of symmetry that are shared by nearly all natural self-assembling structures, we have developed methods for engineering novel proteins that assemble to form a variety of complex, symmetric architectures. Recent successful designs include hollow protein cages composed of 12 or 24 identical subunits in cubic arrangements. Symmetric materials that extend by growth in two or three dimensions are also possible. Natural and engineered protein assemblies will be discussed, along with their future prospects for synthetic biology and biomedical applications.

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COMPLEXITY AND SELF ASSEMBLY

FRIDAY, APRIL 25, 2014

SPEAKERS:
DR. HAO YAN
DR. DONALD INGBER
DR. TODD YEATES

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF KENTUCKY
LEXINGTON, KY 40506-0055

COLLEGE OF ARTS & SCIENCES