UCLA Engineering
HENRY SAMUELI SCHOOL OF
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BIOENGINEERING

PRESENTS

Interfacing molecules, cells, and microfabrication.

THURSDAY, MAY 5, 2016
1:00 PM – 2:00 PM
2101 ENGINEERING V

Paul Rothemund, Ph.D.

California Institute of Technology
Research Professor, Department of Bioengineering

ABSTRACT:

In this talk, we will focus on two topics: (1) the integration of atoms and molecules with semiconductor microfabrication, and (2) initial steps towards the introduction of RNA scaffolds for proteins into living cells.

Conventional silicon microfabrication has been extraordinarily successful for creating a wide variety of electronic, optical, and mechanical devices. However, unconventional components such as carbon nanotubes, gold nanoparticles, colloidal quantum dots, proteins, or single atom dopants offer unique properties which are unavailable to the materials normally used in microfabrication. Thus "hybrid nanodevices" in which a molecule or nanoparticle is positioned within the heart of a microfabricated device are of great interest. The problem is, how can one best arrange molecules or nanoparticles within a microfabricated device? We will present a directed self-assembly approach, in which large DNA origami shapes are used as adaptors to carry unconventional components into the heart of microfabricated devices. In particular, we demonstrate this technique for light emitters within photonic crystal cavities, and demonstrate how the nanoscale positioning of DNA shapes within these cavities can be used both to measure and to control their optical properties.

DNA origami are popular for a variety of in vitro devices that scaffold multiple proteins into arrays so that their cooperative behavior can be studied and engineered. But some of the most interesting proposed applications for such protein scaffolds are envisioned to operate within living cells. The question becomes, how can one genetically encode such origami scaffolds within cells? The ready-made cellular machinery for production of large amounts of RNA suggests that "RNA origami" might provide a solution. However, the architecture which works so well for DNA origami will not work for RNA origami, and so we will present research towards a different architecture designed to fold cotranscriptionally within cells.

BIOGRAPHY:

Dr. Paul W.K. Rothemund graduated from Caltech with a dual-major in Biology and Engineering (C.S.) in 1994. For work in an undergraduate information theory class, he received a patent for the first general-purpose DNA computer. After receiving a Ph.D. in Computer Science at USC in 2001, he returned to Caltech, where he developed a variety of approaches to building structures from DNA, including algorithmic self-assembly, DNA tubes, and DNA origami. As Caltech research faculty since 2008, he has maintained a group focused on some of the most difficult problems facing programmable self-assembly: scaling the resolution of structures both down to that of protein, and up to that of the cytoskeleton, interfacing with both semiconductor microfabrication, and living cells.