PRESENTS

Biomolecular Engineering for Non-Invasive Imaging and Control of Biological Function

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10:00 AM – 11:00 AM
8500 Boelter Hall (Penthouse)

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ABSTRACT:

Many important biological processes – ranging from simple metabolism to complex cognition – take place deep inside living organisms, yet our ability to study them in this context is very limited. Technologies such as fluorescent proteins and optogenetics enable exquisitely precise imaging and control of cellular function in small, translucent specimens using visible light, but are limited by the poor penetration of such light into larger tissues. In contrast, most non-invasive technologies such as magnetic resonance imaging (MRI) and ultrasound – while based on energy forms that penetrate tissue effectively – lack the needed molecular precision. Our work attempts to bridge this gap by engineering new molecular technologies that connect penetrant energy to specific aspects of cellular function *in vivo*. In this talk, I will describe molecular reporters for non-invasive imaging using MRI and ultrasound developed by adapting and engineering naturally occurring proteins. These proteins have physical properties, such as paramagnetism or self-assembly into hollow nanostructures, that allow them to be sensitively detected with MRI and ultrasound. By engineering them at the genetic level, we have adapted these natural constructs into non-invasive molecular reporters of biological processes ranging from gene expression to chemical neurotransmission and metabolism. In addition, I will describe recent work on the use of penetrant forms of energy to control cellular function within the body.

BIOGRAPHY:

Dr. Mikhail Shapiro is an Assistant Professor of Chemical Engineering and a Heritage Principal Investigator at the California Institute of Technology. His research is focused on developing molecular technologies to image and control biological function non-invasively in living organisms. Dr. Shapiro received his PhD in Biological Engineering from the Massachusetts Institute of Technology and a BSc in Neuroscience from Brown. He conducted post-doctoral research in biophysics at the University of Chicago and was a Miller Fellow at the University of California, Berkeley. Dr. Shapiro has been awarded the Hertz, Soros, Miller and Life Science Research Foundation fellowships, the Burroughs Wellcome Career Award at the Scientific Interface, the DARPA Young Faculty Award and the Pew Scholarship in the Biomedical Sciences. The *Technology Review* has recognized him as one of the world's top 35 innovators under age 35. More information about the Shapiro Lab can be found online at **shapirolab.caltech.edu**.