

Title: Engineering Molecular Technologies to Sense Neural Activity with MRI

Speaker:

Mikhail G. Shapiro, PhD

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Departments of Bioengineering and Molecular & Cell Biology

University of California, Berkeley

Date: Wednesday, 4 January 2012

Time: 11:30 am

Venue: Room 603, Chow Yei Ching Building

Abstract:

Magnetic resonance imaging (MRI) is a technology uniquely suited to studying brain function because it freely penetrates tissues and has relatively high spatial and temporal resolution. However, the range of neural signaling events traditionally accessible to MRI has been limited due to its reliance on hemodynamic signals. We have created new genetically engineered molecular sensors capable of sensing neural signaling events directly using MRI. One technology is based on a bacterial enzyme that produces changes in MRI T1 contrast in response to small molecule binding. We used directed evolution to convert this protein from a catalyst of fatty acid hydroxylation into an MRI sensor of the neurotransmitter dopamine (DA), and used it to image DA release in rats. Another technology is based on the human iron storage protein ferritin, which we rationally engineered to self-assemble inside cells into quantitative MRI (T2) sensors of protein kinase activity. These technologies provide proofs of concept for the development of a genetic toolkit for MRI molecular imaging.

Biography of the speaker:

Mikhail Shapiro is a Miller Research Fellow at the University of California at Berkeley, where he is developing new technologies to non-invasively sense and manipulate brain activity at the molecular level. Dr. Shapiro received his PhD in biological engineering from MIT as a Hertz and Soros fellow advised by Robert Langer and Alan Jasanoff. He has a BSc in neuroscience from Brown University, and conducted

post-doctoral training in biophysics at the University of Chicago. Dr. Shapiro has pioneered the development of genetically encoded functional MRI sensors of neural activity. He has been awarded the Hertz, Soros, Miller and Life Science Research Foundation fellowships and the Hertz PhD thesis prize. In 2010 he was recognized by MIT's Technology Review magazine as one of the world's top 35 innovators under age 35.

Organizer: Prof. E.X. Wu