Improved red fluorescent genetically-encoded calcium indicators for in vivo imaging

Hod Dana, Boaz Mohar, Yi Sun, Jeremy P. Hasselman, Getahun Tsegaye, Graham T. Holt, Ben F. Fosque, Eric R. Schreiter, Stephan D. Brenowitz, Vivek Jayaraman, Loren L. Looger, Karel Svoboda, Douglas S. Kim

Genetically-Encoded Neuronal Indicator and Effector Project

Motivation
- Optical imaging of calcium dynamics using genetically-encoded calcium indicators (GECIs) is a powerful tool for systems neuroscience
- Current state-of-the-art GECIs emit green light (green GECIs)
- Red GECIs may be used for:
  - Deep tissue imaging
  - Parallel use with light-sensitive ion channel (ChR2)
- Here we present high-sensitivity red GECIs, jRGECO1a, jRCaMP1a, and jRCaMP1b for in vivo imaging of neural activity.

In vivo functional imaging in V1

In vivo relationship between spikes and fluorescence dynamics

Conclusions
- New jRGECO1a, jRCaMP1a, and jRCaMP1b indicators have improved sensitivity and kinetics
- jRGECO1a in vivo performance is similar to GCaMP6
- jRCaMP1 indicators combine improved sensitivity and photostability
- Reagents distributed through Addgene.org and Penn Viral Vector Core