Assistant Professor of Biology
Viviana Gradinaru

Postdoctoral Fellows
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Graduate Students
Claire Bedbrook, Ken Chan, Nick Flytzanis, Ryan Cho, Bin Yang

Research and Laboratory Staff
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Undergraduate Students
Christopher Finch (Summer; Amgen), Snigdha Kumar (Caltech), Victoria Servin (MURF)

Lab Website

Financial Support:
City of Hope Biomedical Research
Edward Mallinckrodt Jr. Foundation
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National Institute on Aging
National Institute of Mental Health
NINDS
Sidney Kimmel Foundation
The Beckman Institute
The Mallinckrodt Foundation
The Moore Foundation
The Pew Charitable Trusts

HONORS AND AWARDS
2014 Allen Brain Institute Next Generation Leaders Council Member
2014 Cell 40 under 40
2013 Pew Research Scholarship in the Biomedical Sciences
2013 NIH Director’s New Innovator Award  
2013 Named a World Economic Forum Young Scientist  
2013 Pew Scholar Award  
2013 Human Frontier Science Program (HFSP) Young Investigator Grant

**TALKS**

2014 CNC Program Annual Symposium, Stanford, California, USA  
2013 Allen Brain Institute 10th Anniversary Symposium, Seattle, USA  
2013 UCLA Learning and Memory Symposium; USC Seminar  
2013 TEDxCaltech: The Brain on “Brain Control with Light - Development and Application”

**CONTROL OF BRAIN FUNCTION AND BEHAVIOR**

The Gradinaru Lab studies the mechanism of action for deep brain stimulation (DBS), a therapeutical option for motor and mood disorders such as Parkinson’s and depression. Our previous work highlighted the importance of selectively controlling axons and not local cell bodies in modulating behavior, a principle that might play a generalized role across many effective deep brain stimulation paradigms. *We are now particularly interested in the long-term effects of DBS on neuronal health, function, and ultimately behavior.*

In addition, the lab will continue to push forward optogenetic technologies by developing tools for electrical and biochemical control and localizing them to subcellular compartments. To achieve the goals of neuronal circuits investigation and tool development for neuroscience the Gradinaru lab will use advanced Molecular and Synthetic Biology; Electrophysiology (in vitro and in vivo); Behavior; Imaging (2-photon), Optogenetics (gene delivery of photosensitive proteins to specific cell types) and CLARITY (slicing-free whole brain imaging and molecular phenotyping).

*Gradinaru Lab will be a great fit for any interdisciplinary-minded person. Projects in the lab range from studying the impact of neuromodulation on neurodegeneration and behavior to engineering needed tools (molecular, cellular, hardware) for neuroscience research. If you are interested in joining our team, please email Dr. Gradinaru your CV and a brief description of your scientific interests.*

**PERSONAL STATEMENT**

My work has focused on developing and using optogenetics (Gradinaru et al., Cell, 2010) and CLARITY (Chung et al., Nature, 2013) to dissect the circuitry underlying neurological disorders such as Parkinson’s (Gradinaru et al., Science, 2009: this study highlighted the importance of selectively controlling axons and not local cell bodies in modulating animal behavior, a principle that might play a generalized role across many deep brain stimulation paradigms for motor and mood disorders). The approach we used to better traffic microbial opsins to the plasma membrane improved an array of opsins (e.g. NpHR, Arch, Mac) for neuroscience and is likely to help with tolerability in mammalian cells of opsins of exotic origin and composition yet to be discovered or engineered. CLARITY renders the tissue transparent for easy visualization and
identification of cellular components and their molecular identity without slicing. This method complements optogenetics, in that it can reveal, with ease, circuit-wide effects of optogenetic manipulations and also aid in mapping novel circuits that need tuning in disease. The Gradinaru group at Caltech now focuses on further understanding deep brain stimulation through a combination of mapping (e.g. CLARITY), optogenetics, and in vivo single unit electrophysiology. We are also developing genetically encoded voltage sensors for this purpose.

PUBLICATIONS

2014


Nicholas C. Flytzanis1±, Claire N. Bedbrook1±, Hui Chiu1, Martin K. M. Engqvist2, Cheng Xiao1, Ken Y. Chan1, Paul W. Sternberg1, Frances H. Arnold2, Viviana Gradinaru, 2014 Archaerhodopsin variants with enhanced voltage sensitive fluorescence in mammalian and C. elegans neurons Nature Communications (in press)

2013

Sukhotinsky I; Chan AM; Ahmed OJ; Rao VR; Gradinaru, V.; Ramakrishnan C; Deisseroth K; Majewska AK; Cash SS. Optogenetic delay of status epilepticus onset in an in vivo rodent epilepsy model. PLoS One, 2013; Apr 24;8(4):e62013. PMID: 23637949
