NY CREATES Emerging Technologies Seminar Series

August 13th (Thursday), 2020: 11:30 am – 12:30 pm

Advance Zoom Registration Required at:

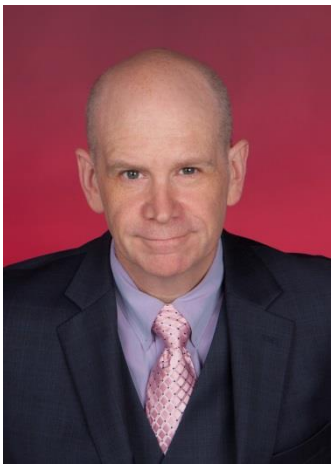
https://us02web.zoom.us/meeting/register/tZ0kce-pqz0jEt3n8LzJ91caLzMHeZam5XI0

"An Optogenetic Brain System (OBServ) to Restore Visual Perception in the Blind"

by: Prof. Stephen Macknik

Professor of Ophthalmology, Neurology, and Physiology/Pharmacology,
SUNY Downstate Health Sciences University, Brooklyn, NY

Abstract: Recent and ongoing imaging advances in in non-human primates open new paths for the development of cortical prosthetics that may restore foveal vision in blind patients. Using precisely targeted optogenetic activation, a cortical prosthetic might optically stimulate spatially localized lateral geniculate nucleus (LGN) synaptic boutons—transfected with light-sensitive proteins and projecting into the primary visual cortex (V1)—in a pattern that mimics naturalistic visual input. Because all long-range connections from the LGN to V1 are glutamatergic, optogenetic targeting of these inputs would be free from unwanted co-activation of inhibitory neurons (a common problem in electrode-based prosthetic devices, which cannot isolate excitatory from inhibitory activation and thus result in diminished contrast perception). Because prosthetic devices can only succeed in driving naturalistic stimulation when they account for rapidly changing cortical activity and response conditions, our system integrates a real-time cortical read-out mechanism to continually assess and provide feedback to modify stimulation levels, just as the natural visual system does. The resultant activity is read-out from a multi-colored array of bioluminescent V1 calcium responses with single-cell resolution. Oculomotor effects are accounted for by tracking eye movements and adjusting the correlated inputs in real-time (just as the natural retina does). This system, called the Optogenetic Brain System (OBServ), is designed to function by optimally activating visual responses in V1 from a coplanar laser-driven grating array/video camera. The OBServ approach follows from the principle that if the LGN input modules are stimulated in the same pattern as natural vision, the recipient should perceive naturalistic prosthetic vision.



Biography: Prof. Stephen Macknik is an award-winning neuroscientist and professor at the State University of New York Downstate Health Sciences University. He is a co-author, with Susana Martinez-Conde, of the international bestseller Sleights of Mind: What the Neuroscience of Magic Reveals About Our Everyday Deceptions, and the recently published Champions of Illusion, and he has written for publications such as Scientific American, The New York Times, The Sunday Times (London), and How It Works. His Scientific American Magazines contributions include two current in-print columns (one in Scientific American MIND, and one in Mente y Cerebro, in the Spanish language) and three special editions of Scientific American: Mind, each of which are dedicated entirely to their contributions. His research has been covered by The New York Times, The Wall Street Journal, Wired, NPR, PBS's NOVA, Science and Nature magazines, and his US BRAIN Initiative-funded research was recently lauded as revolutionary on the blog of the Director of the National Institutes of Health. With Martinez-Conde, he produces the Best Illusion of the Year Contest. He lives in Brooklyn.