

Synaptic Plasticity and Remodeling in Neural Circuits: Role of Dopamine, Drugs, and Beyond

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ABSTRACT

A major interest of my lab is to delineate the basic principles by which the neuromodulator dopamine drives synaptic and circuit modifications in the prefrontal cortex (PFC) to reinforce reward-related behaviors. PFC is a key site of the reward circuitry in the brain and also mediates learning, permanent memory storage, and executive functions. Using brain slice electrophysiology, we recently identified a novel circuit mechanism by which dopamine empowers Hebbian synaptic plasticity: a brief pulse of dopamine is needed for spike-timing dependent long-term potentiation (tLTP) in distal synapses of projection neurons. The underlying mechanisms involve a D2 dopamine receptor “gate” in inhibitory microcircuits and a D1 dopamine receptor “coincidence modulator” in excitatory microcircuits, which cooperate to permit tLTP in native circuits. However, this cooperative nature of dopamine effects may be extremely delicate, as our studies in mutant transgenic mice showed that excessive dopamine impairs, rather than facilitates, LTP. In addition, this mechanism is also sensitive to disruption by substances of abuse, which target the reward circuitry to cause addiction. Our work on localized dopamine signaling within dendritic spines has provided important insights into the molecular processes underlying the important yet delicate role of dopamine in synaptic plasticity. These studies represent a significant step forward in understanding and potential treatment of neuropsychiatric disorders, including schizophrenia, addiction, and ADHD.

BIOGRAPHY

Dr. Wei-Dong Yao is an Assistant Professor of Psychiatry at Harvard Medical School and Chief of Cellular Molecular Neuroscience Laboratory at Harvard's Primate Research Center. Dr. Yao is also an adjunct professor at the University of Massachusetts, Amherst. He received his B.S. and M.S. degrees in Physics from Tsinghua University and a Ph.D. in Neurobiology from the University of Iowa. He completed a postdoctoral fellowship at Duke University Medical Center and the Howard Hughes Medical Institute before joining Harvard faculty in 2005. Dr. Yao's research interests are activity-dependent synaptic plasticity and neural circuit remodeling, as they relate to neuropsychiatric and neurological disorders. His work has been published in premiere journals and highlighted on national and international news media, such as *NBC*, *Routers*, and Harvard's *Focus*. His research is supported by NIH and private foundation funds. He has given over 40 invited talks, served on national (e.g. NIH and NSF) and international (e.g. Human Frontier Science) grant review panels, and is a frequent *ad hoc* reviewer for scientific journals and publishers. Prof. Yao was a recipient of the NARSAD Young Investigator Award, the William F. Milton Fund for Career Development at Harvard, and the NCCR shared instrumentation grant award.



EVENT DETAILS

DATE:

Wednesday, February 15, 2012

TIME:

11:00 a.m.

LOCATION:

Babbio 122
Stevens Institute of Technology

ATTENDANCE:

This event is open to Stevens' Faculty, Students, Staff, and Invited Guests

RSVP:

ME Department Host:
Prof. Yong Shi
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