



KEYNOTE SPEAKER: Grand Prize Winner of the Science & SciLifeLab Prize for Young Scientists 2016

Neir Eshel

Dopamine, acetylcholine and the value of effort

Abstract

Effort is costly: given a choice, we tend to avoid it. But in many cases, effort is also valued. Experiments across species have demonstrated numerous examples where individuals value outcomes more after working harder for them. Despite accumulating evidence on the value of effort, however, little is known about the underlying neural substrates. We recently found that dopamine (DA) release in the core of the nucleus accumbens (NAc) tracked the effort required for reward, even when the reward was kept constant. When mice worked harder for reward, more DA was released in response to the cue denoting reward delivery. Our findings provide a plausible neural basis for how effort can augment a reward's value.

We are now situating our findings within the larger striatal circuit, discovering both what generates this DA effort signal (i.e., one synapse upstream), and how it modulates neural circuit function (i.e., one synapse downstream).

In exciting preliminary data, we have discovered that cholinergic interneurons in the NAc encode effort, and their activity is essential to augment DA release in high-effort conditions. The cholinergic interneurons appear to inherit their effort encoding from long-range excitatory inputs, and when their signaling is disrupted, mice no longer work as hard for reward. In sum, we have begun to draw a circuit diagram for effort valuation, revealing how key cell types and neuromodulators interact in the striatum to drive effortful behavior.

Biography

Neir Eshel, MD PhD is an assistant professor of psychiatry and behavioral sciences at Stanford University. He earned his AB from Princeton University, MSc from University College London, and MD-PhD from Harvard University.



For his PhD work, he used optogenetics, electrophysiology, and behavioral approaches to probe the neural circuit regulating dopamine release as mice learned about rewards, earning the Grand Prize of the 2016 Science & SciLifeLab Prize for Young Scientists. He then completed psychiatry residency at Stanford University, where he extended his interest in dopamine to study the role of this circuit in clinically-relevant behaviors, including aggression and anhedonia.

In addition to his research, he maintains a clinical practice and hopes to translate his basic neuroscience findings into new treatment options for his patients.