Neural circuit mechanism of decision-making and reward-dependent learning

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In this talk, I will first summarize our modeling research, carried out in close interplay with experiments, that has revealed some basic neural microcircuit mechanisms of value-based decision-making (1). Then, I will argue that time is ripe to go beyond local circuits towards understanding large-scale brain systems in reward-dependent choice behavior. I will discuss a recent work on a multi-module neural circuit model that suggests a crucial role of feedback cortical projections in reinforcement learning (2). This cortical circuit model combined with the basal ganglia and thalamus (3) could potentially offer a biologically-based computational platform for investigating decision-making and reward-dependent learning in the global brain.

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2. Engel TA, Chaisangmongkon W, Freedman DJ, Wang X-J (2015) Choice-correlated neural fluctuations underlie learning categorical representations. Nature Communications, 6:6454, doi: 10.1038/ncomms7454

3. Wei W, Wang X-J (2016) Inhibitory control: interplay with working memory and decision-making and complex modulation in the cortico-basal ganglia-thalamocortical circuit. Under review at Neuron.