



Talks by rising stars of neuroscience

**Dissecting the role of accumbal D1 and D2 medium spiny neurons in information encoding**

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Nearly all motivated behaviors require the ability to associate outcomes with specific actions and make adaptive decisions about future behavior. The nucleus accumbens (NAc) is integrally involved in these processes. The NAc is a heterogeneous population primarily composed of D1 and D2 medium spiny projection (MSN) neurons that are thought to have opposed roles in behavior, with D1 MSNs promoting reward and D2 MSNs promoting aversion. Here we examined what types of information are encoded by the D1 and D2 MSNs using optogenetics, fiber photometry, and cellular resolution calcium imaging. First, we showed that mice responded for optical self-stimulation of both cell types, suggesting D2-MSN activation is not inherently aversive. Next, we recorded population and single cell activity patterns of D1 and D2 MSNs during reinforcement as well as Pavlovian learning paradigms that allow dissociation of stimulus value, outcome, cue learning, and action. We demonstrated that D1 MSNs respond to the presence and intensity of unconditioned stimuli – regardless of value. Conversely, D2 MSNs responded to the prediction of these outcomes during specific cues. Overall, these results provide foundational evidence for the discrete aspects of information that are encoded within the NAc D1 and D2 MSN populations. These results will significantly enhance our understanding of the involvement of the NAc MSNs in learning and memory as well as how these neurons contribute to the development and maintenance of substance use disorders.

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