

This Week in The Journal

Neuronal Subpopulations Controlling Drug-Seeking Behaviors

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(see pages 4019–4032)

Opioid addiction behaviors are rooted in pathophysiological changes in the brain. This week, Kokane et al. examine addiction-related changes in neuronal subtypes of the prelimbic (PL) prefrontal cortex (PFC) that project to the ventral striatum, or nucleus accumbens (NAc). Recent work pointed to different roles for subpopulations of PFC neurons expressing either the dopamine receptor type 1 ($D1^+$) or type 2 ($D2^+$). Here, experiments in transgenic rats revealed layer-specific segregation and different intrinsic firing properties of $D1^+$ and $D2^+$ cells in the PL. Rats were trained to self-administer heroin and then underwent 7 d of forced abstinence; rats relapsed to heroin seeking following presentation of heroin-associated cues. Patch-clamp recordings of $D1^+$ and $D2^+$ neurons in PL slices showed that heroin abstinence led to increased firing in both types of neurons, which normalized after cue-induced heroin seeking. The amplitude of sEPSCs (synaptic plasticity) of $D1^+$ but not $D2^+$ neurons was increased during abstinence, which also reversed with relapse. Changes in specific electrophysiological properties of the neurons differed between $D1^+$ and $D2^+$ neurons, suggesting that the molecular underpinnings may differ. The researchers next wanted to gauge the role of protein kinase A (PKA) in the drug-associated excitability changes, so they incubated PL slices from rats after 7 d of heroin abstinence with RP-adenosine-3',5'-cyclic-phosphoro-thioate (RP-cAMPs), an antagonist of PKA activity. The treatment decreased the abstinence-evoked increase in firing of both $D1^+$ and $D2^+$ neurons

and the amplitude of sEPSCs only in $D1^+$ PL→NAc neurons. The findings indicate that PKA activity is responsible for the heroin-associated increase in neuronal excitability and synaptic plasticity in PL neurons that project to the NAc. The findings suggest that PKA also influences synaptic plasticity and affects $D1^+$ and $D2^+$ neurons differently. An infusion of RP-cAMPs in the PL of rats that had self-administered heroin followed by abstinence decreased cue-induced relapse, suggesting that PKA also drives relapse to heroin seeking. The work extends researchers' knowledge of the role of neuronal subpopulations driving addiction behaviors.



Network visualization of 148 interdependent personality traits. Colors denote trait "communities," and larger dots have more dependencies.

A Model for Updating Our Self-Concept Based on Social Feedback

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(see pages 4110–4128)

How do we form our sense of self, our concept of what we are like as a person? Whatever our personality traits, we learn about them from our own personal experience, but also from feedback from social

interactions. To maintain a coherent and positive self-concept, new and sometimes conflicting information must be integrated into this structure, often with implications for other, related and interdependent, traits. This week, Elder et al. use network analysis and brain imaging to create a model of self-belief. College undergraduate students were first interviewed about their characteristics and goals under the false premise that members of the University admissions committee would view the recorded video and assess the participants' traits. About a week later, the students returned to complete self-assessment questionnaires, rating themselves on a 7-point scale on 148 trait words, and to hear the made-up feedback, all while they underwent functional magnetic resonance imaging. After hearing all of the feedback, participants again completed the self-assessment questionnaires before being debriefed about the true nature of the study. The authors wanted to test the role of dependency information—or how interdependent a trait is with other traits—in updating self-views from social feedback. Their model of self-belief updating incorporated a reinforcement learning model within the network structure. Positive feedback was more rapidly incorporated into the network than negative feedback, and traits with more dependencies were more resistant to change from new feedback. When feedback conflicted with existing beliefs, the error was back-propagated to related traits within the network. In the brain, the authors focused on the ventral medial prefrontal cortex (vmPFC), an area previously associated with self-assessment. The vmPFC responded more strongly to positive feedback on traits with more dependencies, and less strongly to negative feedback on traits with more dependencies. The study provides a fuller understanding of the brain processes that give rise to our ever-evolving concept of self.

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