Learning addiction: Dopamine reinforces drug-associated memories

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New research with mice has provided some fascinating insight into how addictive drugs hijack reward signals and influence neural processes associated with learning and memory. The research, published by Cell Press in the September 10th issue of the journal *Neuron,* helps to explain why and how drug-associated memories, such as the place of drug use, drive and perpetuate the addiction.

The neurochemical dopamine, a key player in the brain's reward system, is known to be involved in the process of addiction. Research has indicated that dopamine participates in neural processes associated with learning, such as the strengthening of neuronal connections, called synaptic potentiation. Evidence also implicates the hippocampus, a deep-brain structure that is critical for formation of new memories, in the development of drug addiction.

"Although addictive drugs like nicotine have been shown to influence the induction of synaptic potentiation, there has been little or no research in freely moving animals that monitors ongoing induction of synaptic potentiation by a biologically relevant drug dose," explains senior author Dr. John Dani from the Department of Neuroscience at the Baylor College of Medicine in Houston, Texas. Dr. Dani and Dr. Jianrong Tang recorded from the brains of freely moving mice while applying physiologically relevant concentrations of nicotine, the addictive component in tobacco.

The researchers observed that nicotine induced synaptic potentiation

correlated with the mice learning to prefer a place associated with the nicotine dose. Importantly, these effects required a local dopamine signal within the hippocampus. This finding reinforces the view that dopamine enables memory for specific events.

Taken together, these results point to some intriguing possibilities about how drug-associated memories might contribute to behaviors associated with addiction. "An animal's memories or feelings about the environment are updated when the dopamine signal labels a particular event as important, new, and salient. Normally these memories help us to perform successful behaviors, but in our study, those memories were linked to the addictive drug," concludes Dr. Dani. "When specific environmental events occur, such as the place or people associated with drug use, they are capable of cuing drug-associated memories or feelings that motivate continued drug use or relapse."

Source: Cell Press (news : web)