

Rats can make good choices:
**Effect of alternative food and social rewards on drug use and relapse in rat models of
addiction**

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Abstract

In previous studies, we and others used a rat model of drug relapse and craving to demonstrate time-dependent increases in drug seeking following experimenter-imposed (forced) abstinence in the homecage—a phenomenon we termed incubation of drug craving (Grimm et al., *Nature*, 2001). More recently, we developed a rat model to study drug craving and relapse following extended periods of voluntary abstinence in the drug-associated environment. Voluntary abstinence is achieved through a mutually exclusive discrete-choice procedure, in which male and female rats with a history of intravenous opioid or psychostimulant self-administration choose daily between palatable food or social interaction with a peer versus the addictive drug. We propose that these voluntary abstinence models reflect key elements of operant-based human treatments, such as contingency management (where alternative rewards are monetary vouchers) and the community reinforcement approach (where positive social interactions serve as reinforcement). In this lecture, I will introduce the voluntary abstinence models and present behavioral and neural circuit analyses of drug craving and relapse after the removal of the food or social rewards.

Biography

Yavin Shaham earned his B.S. and M.A. from Hebrew University in Jerusalem and his Ph.D. from the Uniformed Services University of the Health Sciences in Bethesda, MD. He completed postdoctoral training at Concordia University in Montreal under the mentorship of Dr. Jane Stewart. Before joining the NIDA Intramural Research Program (IRP), he was an investigator at the Addiction Research Center in Toronto. He is currently a tenured Branch Chief and Senior Investigator at NIDA. Shaham's major awards include the Society for Neuroscience's Jacob Waletzky Award for innovative research in drug and alcohol addiction (2006), the NARSAD Distinguished Investigator Grant Award (2016), the NIDA-IRP Investigator Mentoring Award (2016), the European Behavioral Pharmacology Society (EBPS) Distinguished Achievement Award (2017), the NIH Director's Award of Merit (2020), and the NIH Ruth Kirschstein Mentoring Award (2022). In 2023, he was invited to present his research at a Nobel symposium on the "Social Brain." Shaham has published over 250 empirical papers, reviews, and commentaries, with more than 45,000 citations and an h-index of 116 (Google Scholar). In 2018, Shaham was named by The Web of Science as a "Highly Cited Researcher" (top 1%). From 2008 to 2018, he served as a Reviewing and Senior Editor for The Journal of Neuroscience. Currently, he is a Reviewing Editor for Neuropsychopharmacology and an Advisory Board Member for eNeuro. He also serves on the editorial boards of Biological Psychiatry, Psychopharmacology, Behavioural Pharmacology, and Addiction Biology. Additionally, Shaham was the President of EBPS from 2021 to 2023. His research focuses on the mechanisms of relapse to opioid and psychostimulant seeking, using rat models developed in his lab. For more details, visit: <https://irp.drugabuse.gov/organization/bnrb/nrs/>.



Selected empirical papers

- Caprioli et al. (2017) Role of dorsomedial striatum neuronal ensembles in incubation of methamphetamine craving after voluntary abstinence. The Journal of Neuroscience 37:1014-1027
- Venniro et al. (2017) The anterior insular cortex→central amygdala glutamatergic pathway is critical to relapse after contingency management. Neuron 96:414–427
- Venniro et al. (2018) Volitional social interaction prevents drug addiction in rat models. Nature Neuroscience 21:1520-1529
- Venniro et al. (2020) Abstinence-dependent dissociable central amygdala microcircuits control incubation of craving. PNAS 117:8126-8134
- Ramsey et al. (2022) Waving through the window: a model of volitional social interaction in female mice. Biological Psychiatry 91:988-997
- Claypool et al. (2023) Role of piriform cortex and its afferent projections in relapse to fentanyl seeking after food choice-induced voluntary abstinence. The Journal of Neuroscience 43:2597-2614

Selected reviews

- Venniro et al. (2020) Improving translation of animal models of addiction and relapse by reverse translation. Nature Review Neuroscience 39:3996-4008
- Fredriksson et al. (2021) Animal models of drug relapse and craving after voluntary abstinence: a review. Pharmacological Review 73:1050-1083
- Nicolas et al. (2022) Sex differences in opioid and psychostimulant craving and relapse: a critical review. Pharmacological Review 74:119-140
- Venniro et al. (2022) The protective effect of social reward on opioid and psychostimulant reward and relapse: behavior, pharmacology, and brain regions. The Journal of Neuroscience 42:9298-9314
- Chow et al. (2025) Neurobiology of the incubation of drug craving: an update. Pharmacological Reviews 77:100022