Electrophysiological changes in sensory encoding reflect experience-dependent plasticity specific to opioid and cocaine-associated cues

Dylan Sullivan,[2] Mark A. Presker Jr, MA[1], Gary Aston-Jones, PhD[1], and Kasia M. Bieszczad PhD[2]

[1]Brain Health Institute,[2]Department of Psychology, Rutgers - The State University of New Jersey, Piscataway, New Jersey

Rutgers Brain Health Institute

brainhealthinstitute.rutgers.edu/

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Background

Cocaine and opioids are very powerful drugs that can elicit cravings and cause relapse simply through drug associated stimuli.

Previous research has shown that drugs of abuse alter sensory encoding pathways, which change the way environmental stimuli are encoded, such as a particular song that someone listened to every time they used.

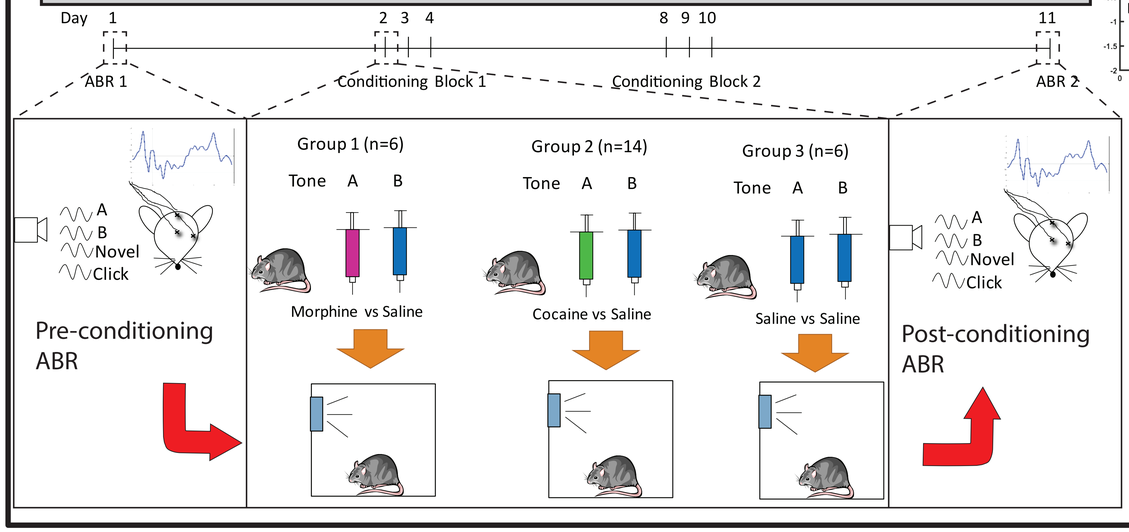
Although research has explored changes in sensory encoding pathways due to drug use, little has been done to determine the long-term effects.

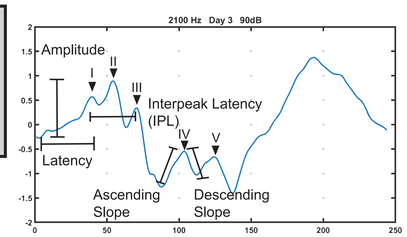
An effective way to measure how drug-associated stimuli are processed and encoded in the brain is through auditory brain stem response (**ABR**) recordings in which drug and non-durg associated tones are played while recordings are taken.

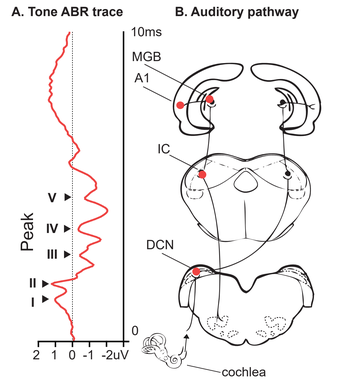
Changes in ABR morphology are examined to see how the subject encodes these stimuli.

Methods

Below: A pre-conditioning ABR is taken for a baseline measure of auditory brainstem activity. Subjects undergo 6 days of training, 2 blocks per day, to associate tones with drug or saline. A post-conditioning ABR is taken to measure possible changes in brain activity.
Right Top: An example of an ABR trace that outlines characteristic peaks and basic peak features
Right Bottom: Outines which auditory brainstem structures are associated with each peak







Conclusions

Drugs of abuse have clear global effects on sensory processing and specific effects on the processing of drug cues.

Generally, drugs of abuse add variance into the response to auditory stimuli.

There are also changes in the brain that are specific to each drug, such as increased threshold with cocaine and increased response time in Peak I with morphine, that have phsyiological bases.

These changes in response to auditoy cues are seen in general ABR morphology as well as specific featrues of peaks.

Our hypothesis that the auditory brainstem encodes opioid-associated and cocaine associated tones as salient stimuli, and there are differences between how each drug effects early sensory procesing.

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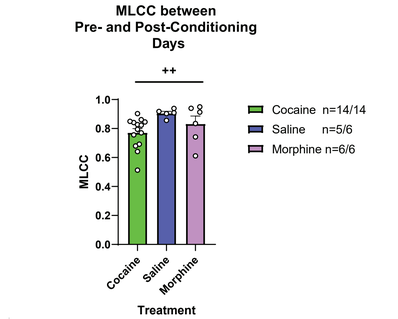
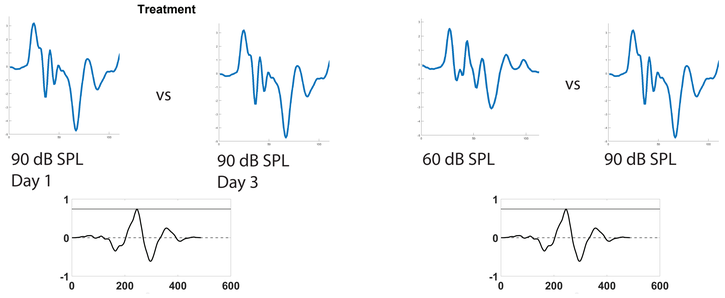
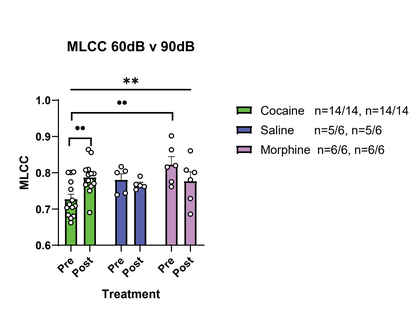
Results

Overall ABR morphology changes in response to drug exposure

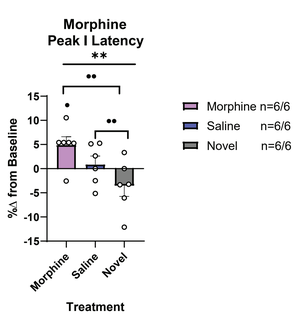


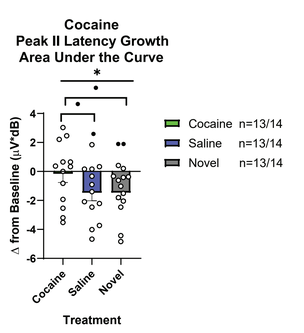


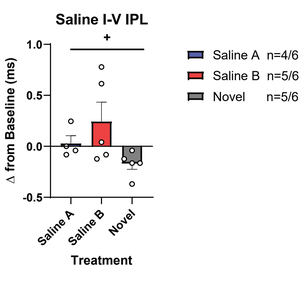
Threshold changes in response to drug expusre

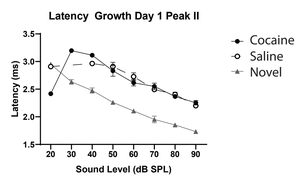


Exposure to drug leads to drug-specific changes in auditory processing

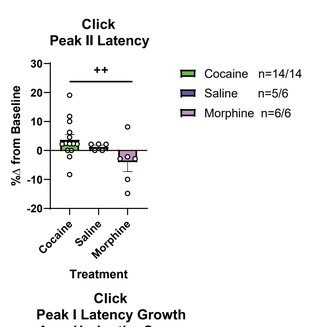


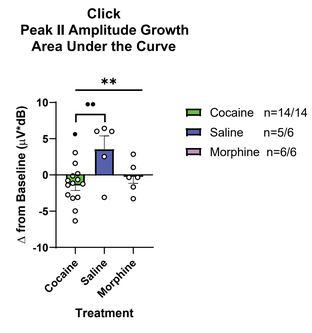


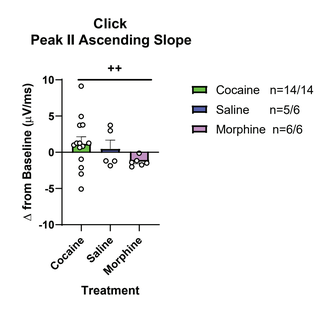


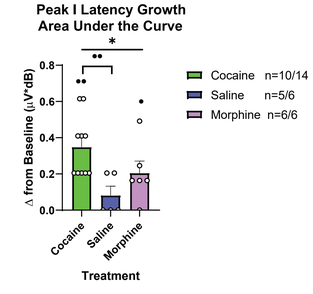


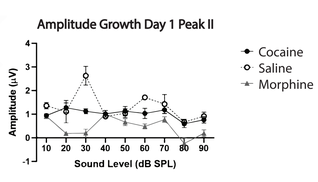
Exposure to drug leads to global changes in auditory processing

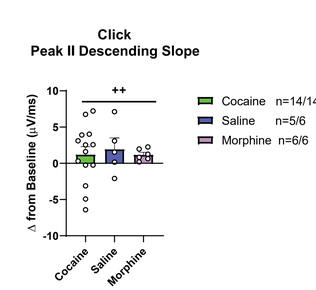












Bartlett's Test: + = p < 0.05, ++ = p < 0.01, +++ = p < 0.005, ++++ = p < 0.001; **RM One-way/Two-way ANOVA:** * = p < 0.05, ** = p < 0.01, *** = p < 0.005, **** = p < 0.001; **Post Hoc:** • = p < 0.05, •• = p < 0.01, ••• = p < 0.005, •••• = p < 0.001