Effects of repeated cocaine exposure on pair-bond formation in prairie voles

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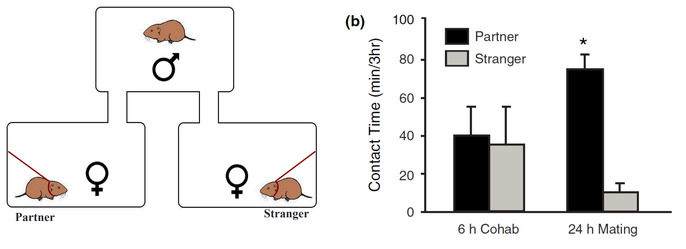
Background and Purpose

Partner Preference | **Selective Aggression** | **Bi-parental Care**

Photos: Smith Lab, University of Kansas

- It has been well established that drug use negatively impacts both mental and physical health and can damage personal relationships. However, little is known about how drugs of abuse can affect our ability to form and maintain social bonds.
- Socially monogamous prairie voles form intense and enduring social attachments, showing a preference for their partner over a stranger. Once a bond has formed, the animals will share territory, raise offspring together, and display aggression towards conspecifics.
- Repeated exposure to amphetamine inhibits formation of a partner preference in prairie voles (Liu et al., 2010).
- The purpose of this study is to determine how a history of cocaine use affects the ability to form and maintain social bonds.

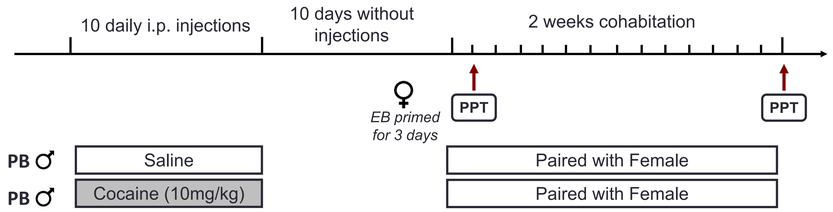
Partner Preference



(Gobrogge & Wang, 2015)

- We can test for partner preference in the lab by giving the test animal the choice between their partner and a stranger of the opposite sex. If a pair bond has formed, they should show a preference for their partner over the stranger, spending more time in side-to-side contact with their partner.
- Previous work has shown that 24 hours of cohabitation with mating is sufficient to produce a partner preference

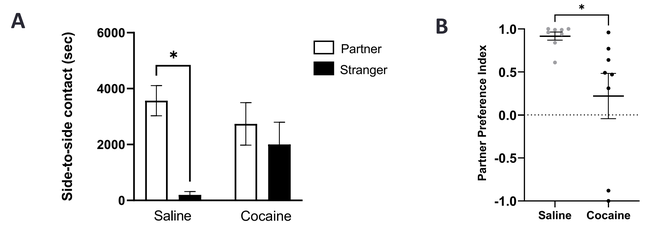
Materials and Methods



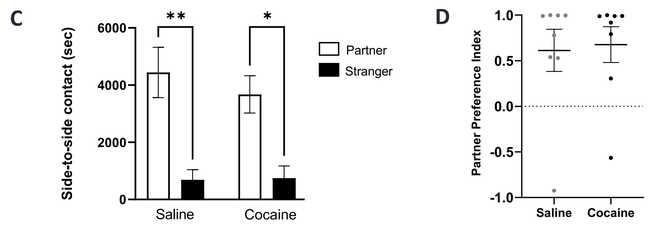
Male prairie voles received daily i.p. injections of either saline or cocaine (10mg/kg) for 10 days, followed by 10 days with no injections. The males were then paired with a female mate that was primed with estradiol benzoate for three days to induce receptivity. The male prairie voles were tested for a partner preference after 24-hours of cohabitation and again after 2 weeks of cohabitation.

Results

24 hours



2 Weeks



A. 3hr PPT after 24hrs of cohabitation. Saline group shows a strong preference for partner over stranger, spending a significantly greater amount of time in side-to-side contact with the partner (2-way ANOVA; $p < 0.05$). **B.** Partner Preference Index for 3hr PPT after 24hrs of cohabitation. The saline group has a significantly higher preference index compared to the cocaine exposed group (Unpaired t-test; $p < 0.05$). **C.** 3hr PPT after 2 weeks of cohabitation. Both the saline group and the group exposed to cocaine displayed a preference for the partner over the stranger (2-way ANOVA; * $p < 0.05$; ** $p < 0.01$). **D**. Partner Preference Index for 3hr PPT after 2 weeks of cohabitation. No difference between the two groups.

Conclusions

- Previous work has shown that 24-hours of cohabitation with mating is sufficient to form a partner preference in prairie voles
- After 24-hours of cohabitation with mating, the saline control group displayed a preference for their partner, spending significantly more time in side-to-side contact with the partner than the stranger.
- Male prairie voles that were exposed to cocaine for 10 days and paired with a partner following 10 days without cocaine did not develop a partner preference after 24-hours of cohabitation with mating.
- After 2 weeks of cohabitation, both the saline group and the group exposed to cocaine displayed a partner preference.
- These data suggest that a history of cocaine use delays the formation of a partner preference in male prairie voles but does not inhibit the formation of social-bonds entirely.

References

- Gobrogge, K., & Wang, Z. (2015). Neuropeptidergic regulation of pair-bonding and stress buffering: Lessons from voles. Hormones and behavior, 76, 91–105.
- Liu, Y., Aragona, B. J., Young, K. A., Dietz, D. M., Kabbaj, M., Mazei-Robison, M., Nestler, E. J., & Wang, Z. (2010). Nucleus accumbens dopamine mediates amphetamine-induced impairment of social bonding in a monogamous rodent species. *Proceedings of the National Academy of Sciences of the United States of America*, *107*(3), 1217–1222.