**Imaging the Neural Circuitry of Life Threat in Prairie Voles**

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**Background**

Functional MRI in awake prairie voles

Functional magnetic resonance imaging (fMRI) has become a powerful and widely-used tool for investigating changes in brain activity associated with cognitive, affective, and behavioral processes in humans. Snapshots of neural activity across the entire brain in awake rodents can be acquired in a matter of seconds, permitting the visualization of blood oxygen level-dependent (BOLD) changes throughout widely-distributed functional neural networks. Prairie voles and humans share a monogamous social system, biparental care of offspring, and high parasympathetic tone. Thus, neuroimaging voles may provide important insights into the neural regulation of socioaffective processes.

Life threat fear and the impact of social role

We presented awake voles restrained in the magnet (or a simulated magnet) the odor of ferret, a natural predator to examine the neural autonomic correlates of the defense cascade. Prairie vole fathers take an active role in care of the offspring, by huddling over the litter while mother is out of the nest or by inspecting potential threats to the family. Thus, we compared the brain's response to ferret in virgin males and fathers to investigate the neural basis of paternal vigilance.

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**Results**

**Heart rate**

**Heart rate variability**

Central amygdala BOLD in fathers

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**Methods**

Magnet Specifications

Brookhaven 7 T 32 USR 32.1.0.2.0 Horizontal bore 32 x 32 x 32 mm FOV 2.5 mm x 2.5 mm Resolution 256 x 256 fMRI Fast-EPAXE. Single-Shot, Turbo Spin-Echo.

Vole Restraint:

- Takes ~1 minute
- Accomplished without anesthesia

Fear Neural Circuit

3D Activation Map

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**Summary**

We can image neural responses in awake prairie voles without anesthesia to study how the brain changes during a shift from danger to the threat of a real threat, which shows a robust response to threat (e.g., central amygdala) known to regulate the cardiorespiratory and autonomic nervous system. Future studies will explore the autonomic, behavioral and neuroendocrine correlates of paternal behavior in vole and fatherhood in humans.

Prairie voles show dramatic individual differences in the response to predatory threat. Future studies will report on behavioral and physiological correlates of different patterns of responding during the defense cascade.

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