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**Imaging the Neural Circuitry and
Neurochemical Control of Offensive
Aggression Using fMRI and 3D Computational
Analysis**

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Functional MRI with 3D computational analysis in conscious rats was used to identifying the putative neural circuits activated at the onset of offensive aggression with and without arginine vasopressin (AVP) receptor blockade. Offensive aggression is defined as the initiation of attack behavior toward an opponent. In rats, offensive aggression is always preceded by piloerection and lateral attack. This response pattern is unique to offensive aggression and not observed in defensive or predatory aggression. The autonomic response of piloerection was used as a peripheral sign of offensive aggressive motivation during an imaging session. Male Long Evans rats with a history of cohabitation with a single female were imaged for changes in BOLD signal intensity using multislice fast spin echo at 4.7T. Images were collected under control conditions and following the presentation of their mate/intruder in the MR scanner. The presence of the intruder with their mate caused immediate piloerection and changes in heart rate and respiration. Pronounced changes in BOLD signal intensity occurred in the locus coeruleus, raphe complex, mammillary complex, ventromedial and anterior hypothalami. Intraventricular injection of AVP alone caused robust changes in BOLD signal intensity that mirrored areas selective for AVP receptor binding and overlapped with many of the same areas activated during aggression. Pretreatment with an orally active V1 receptor antagonist SRX251 blocked offensive aggression in bench-top studies and suppressed the pattern of BOLD activation caused by presentation of the intruder or administration of AVP. These findings using fMRI corroborate and extended our understanding of the neural circuitry of offensive aggression and the role of AVP neurotransmission in agonistic motivation.

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