

Could brain abnormalities cause antisocial behavior and drug abuse in boys?

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Antisocial boys who abuse drugs, break laws, and act recklessly are not just "bad" kids. Many of these boys may have malfunctioning brains, according to a new study by researchers at the University of Colorado School of Medicine.

"[Brain](#) responses to everyday rewards and punishments gradually guide most youngsters' decisions to conform with society's rules. However, when these seriously troubled kids experience rewards and punishments, and make decisions, their brains apparently malfunction," said Thomas Crowley, MD, a professor of Psychiatry at the School of Medicine and lead author on the study. "Our findings strongly suggest that brain malfunction underlies their frequent failure to conform to rules, to make wise decisions, and to avoid relapses back to drug use and antisocial acts."

The scientists, including collaborators at the University of Colorado at Boulder and the University of Maryland, studied 20 adolescent boys. On average they had been on probation 139 of the last 180 days; 19 of the 20 had the psychiatric diagnosis of conduct disorder, and all had diagnoses of substance use disorder. They had been abstinent, however, an average of about five weeks when studied. They were compared with 20 other boys who did not have serious antisocial or drug problems, but who were of similar age, ethnicity, and home neighborhoods.

All played a computerized risk-taking game that repeatedly presented a choice between a cautious and a risky behavior: press the left button and

always win one cent, or press the right button and either win five cents or lose ten cents. The scientists examined [brain activation](#) with [functional magnetic resonance imaging](#) (fMRI) as the boys decided to press right or left, and then as they experienced wins or losses after right presses.

Brain activation differed dramatically in the two groups. The anterior cingulate cortex monitors changing rewards and punishments, and then sends that information to another brain region (dorsolateral prefrontal cortex), which regulates one's choices among possible behaviors. During decision-making, antisocial boys had significantly less brain activity than normals in both of those regions, and also in other decision-making areas (orbitofrontal cortex, amygdala, insula).

Altogether, during decision-making about 6000 voxels (a voxel is a tiny cube in the brain) activated significantly less in antisocial boys than in comparison boys. No voxels activated more in antisocial boys. Such under-activity during decision-making could contribute to disinhibited antisocial and drug-using behaviors.

As predicted by others not associated with the study, the antisocial boys also had dysphoria, a chronic sad-anxious state, with "reward insensitivity"; in the game their brains responded less than the comparison boys' brains to wins. They also had "punishment hypersensitivity", with greater brain response to losses than comparison boys.

Interestingly, the number of risky right presses was similar in the two groups. The scientists speculate that this occurred because the game forced the boys to deliberate for several seconds before pressing either button.

More information: The report was published today in the online journal, *Public Library of Science One (PLoS One)*, and it is freely

available.

Provided by University of Colorado Denver

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