

# Brain basis for crime?

February 28 2011, By Evan Lerner

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Adrian Raine, a Penn Integrates Knowledge professor in the Departments of Criminology, Psychiatry and Psychology, presented a collection of his work on neurocriminology that broadly attempts to connect criminal, psychopathic and aggressive behavior to physical characteristics of the brain at the 2011 Annual Meeting of the American Association for the Advancement of Science in Washington, D.C. earlier this month.

Raine's talk was part of a panel titled "Nature, Nurture, and Antisocial Behavior: Biological and Biosocial Research on Crime." His research indicates that psychopaths who are criminal offenders lacking fear, remorse and guilt may show neurological evidence of their differences early in life.

In his most ambitious project, Raine and his colleagues measured autonomic fear conditioning—where the anticipation of a punishment causes an involuntary physical response that can be measured on the skin—in 1,800 children. They then searched for their subjects' court records 20 years later. After controlling for social factors, they found that poor fear conditioning in 3-year-olds increased their odds of becoming a criminal offender by the age of 23.

Structural impairments in the [brain](#) also appear to be in place early in life in offenders. Adults with cavum septum pellucidum—a neurological condition that reflects underdevelopment of the emotion limbic system before the first six months of life—have higher rates of psychopathy, antisocial personality disorder, arrests and convictions.

Raine and his colleagues have demonstrated that adult psychopaths have an amygdala that is 18 percent smaller in size compared to normal controls. The amygdala is part of the brain's limbic system that is critical for emotion, especially for fear conditioning.

Psychopaths also showed lower activity in the amygdala when confronted with moral dilemmas as compared to controls. Raine says this suggests that, "psychopaths know right from wrong, but they do not have the feeling of what is right and what is wrong."

But, Raine says, not all offenders are the same. In a study of spouse abusers, Raine and colleagues demonstrated that when presented with emotionally provocative stimuli, wife abusers showed greater activity in the amygdala, an area that helps generate emotions, and less activity in the prefrontal cortex, which helps regulate emotions, as compared to non-abusers. This suggests that rather than using violence at home in a planned, conscious way to control their spouses, some abusers instead over-react to mildly provocative stimuli with hair-trigger tempers that are partly predicated on brain-based emotional over-reactivity and reduced ability to regulate that emotion.

Raine's ongoing research, conducted with William Laufer, professor of legal studies and business ethics, sociology, and [criminology](#) in the Wharton School, is probing the brains of white-collar criminals.

Presenting the findings of a pilot study, Raine says these offenders show better decision-making and increased attention. They also show an enlargement in areas of the brain responsible for social information processing, emotion regulation, and the monitoring of abstract rewards like money, as compared to carefully matched controls. Raine cautions that this work is very provisional and must be treated with appropriate circumspection.

While neurocriminology has come a long way from the days of measuring murderers' skull circumferences, it still raises fundamental

questions about how justice systems should operate. As Raine puts it: “If offenders have brain dysfunction for reasons beyond their control, should they be held fully responsible for their crimes?”

Provided by Pennsylvania State University

Citation: Brain basis for crime? (2011, February 28) retrieved 26 April 2024 from <https://medicalxpress.com/news/2011-02-brain-basis-crime.html>

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