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USC study hinds faulty wiring in psychopaths
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USC study finds faulty wiring in psychopaths.

Psychopaths have physical abnormalities in two key brain structures responsible for functions ranging from fear detection to information processing, a USC clinical neuroscientist has found in two studies that suggest a neuro-developmental basis to the disorder.

Adrian Raine, a professor of psychology and neuroscience in the USC College of Letters, Arts & Sciences, focused his research on two parts of the brain: the hippocampus, a portion of the temporal lobe that regulates aggression and transfers information into memory and the corpus callosum, which is a bridge of nerve fibers that connects the cerebral hemispheres.

"Scientists have implicated different brain regions with respect to antisocial and aggressive behavior, and all are important and relevant," Raine said.

"But it goes beyond that to the wiring. Unless these parts of the brain are properly wired together, they'll never communicate effectively. They'll never result in appropriate behavior," he said.

Although the neurobiological roots of psychopathy are still being explored, the key behavioral features of a psychopath have been clearly defined.

Psychopaths' criminal tendencies are typically coupled with a lack of inhibitions, emotions and a conscience.

"We don't do bad things because we will feel bad about it," Raine said. "Psychopaths don't have those feelings - they do not have a conscience. That means they can be callous and manipulative. They don't care about other people. If they can get what they want from life by hurting other people, they'll do it."

That lack of emotions often means that psychopaths don't bond with other people in a

normal way.

"Friendship does not mean the same thing to them. They'll use the word love a lot, but they really don't know what love means. They've never properly experienced it," he said.

But while psychopaths may be cold on the inside, they often can appear to be warm and endearing on the outside - a tool used to lure people in to manipulate them.

"They are glib. They use words well and can be charming. That lures people into their devious net," Raine said. "Psychopaths can be the life of the party for a few minutes or a few hours, and it can actually be a wonderful experience brushing shoulders with them. It's when you get to know them in the long term that you begin to see that they are not what they appear to be."

To explore the physical roots to psychopathic behavior, Raine and his colleagues recruited 91 men from Los Angeles' temporary employment pool and gave them a battery of tests to assess cognitive ability, information processing skills and criminal history. They also were given MRIs, or brain scans.

In the study of the hippocampus, the research team expanded the scope of previous studies by comparing the brains of two groups for the first time: "successful" psychopaths - those who had committed crimes but had never been caught - and "unsuccessful" psychopaths - those who had been caught.

The hippocampus plays a critical role in regulating aggression and in learning which situations one should be afraid of - a process called contextual fear conditioning.

With psychopaths, contextual fear conditioning plays a part in learning the concept of what to do and what not to do, Raine said. It has been theorized that the disruption of the circuit linking the hippocampus with the prefrontal cortex could contribute to the impulsiveness, lack of control and emotional abnormalities observed in psychopaths.

"It is learning what is right and what is wrong in a certain situation," he said.

He tested the theory that psychopaths with hippocampal impairments could become insensitive to cues that predicted punishment and capture. As a result, he said, these "impaired" psychopaths were more likely to be apprehended than psychopaths without that deficit.

Fewer than half of both the control subjects and the "successful" psychopaths had an asymmetrical hippocampus.

Ninety-four percent of the unsuccessful psychopaths had that same abnormality, with the right side of the hippocampus larger than the left.

Raine said the results suggest, but don't prove, a neuro-developmental root for psychopathy.

"Abnormal brain development in early life may cause the structural brain abnormalities that result in psychopathy," he said.

These findings were bolstered by the results of the second study, which focused on the corpus callosum.

The corpus callosum is a bundle of nerve fibers that connects the two hemispheres of the brain, enabling them to work together to process information and regulate autonomic function. Raine explored its role in psychopathy for the first time.

"There's faulty wiring going on in psychopaths. They're wired differently than other people," Raine said. "In a way, it's literally true in this case."

He found that the psychopaths' corpus callosums were an average of 23 percent larger and 7 percent longer than the control groups'.

"The corpus callosum is bigger, but it's also thinner. That suggests that it developed abnormally," Raine said.

The rate that the psychopaths transmitted information from one hemisphere to the other through the corpus callosum also was abnormally high, Raine said.

But that didn't mean things worked better.

With an increased corpus callosum came less remorse, fewer emotions and less social connectedness - the classic hallmarks of a psychopath, he said.

"These people don't react. They don't care," Raine said. "Why that occurs, we don't fully know, but we are beginning to get important clues from neuro-imaging research."

Raine's colleagues on the studies were from institutions including USC, Hillside Hospital in Glen Oaks and the National Aeronautics and Space Administration's Goddards Institute for Space Studies.

The hippocampus and corpus callosum studies were published in the journals Biological Psychiatry (January 2004) and Archives of General Psychiatry (November 2003), respectively.

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