



Investigating the Psychopathic Mind

With a mobile brain scanner and permission to work with inmates in New Mexico state prisons, Kent Kiehl hopes to understand what goes awry in the brains of psychopathic criminals

ALBUQUERQUE, NEW MEXICO—Kent Kiehl remembers his first conversation with a psychopath as if it were yesterday. Kiehl had just started a graduate program in psychology, and he intended to study the criminal mind by interviewing prisoners. His first subject was a thief who'd made a fortune robbing banks in North America and lived the high life for years, renting luxury apartments across Europe and—if he did say so himself—enjoying a great deal of success with the fairer sex. “Have you ever had 15 women in one night?” he asked Kiehl.

The man was behind bars not because of a heist gone wrong but because one of his girlfriends was cheating on him. He tracked her down at a motel room and burst in with his gun drawn. He shot her lover, but the man managed to get away. The woman later testified against him in court. If he could do it all over again, he told Kiehl, he would have killed them both. Such stories fascinate Kiehl, now an associate professor of psychology and neuroscience at the University of New Mexico and director of Mobile Imaging Core and Clinical Cognitive Neuroscience at the Mind Research Network

(MRN) in Albuquerque. “The other 300 or so psychopaths I’ve interviewed are just as interesting,” he says.

At age 38, Kiehl is embarking on a project he hopes will unravel the neural basis of psychopathy, a suite of personality and behavioral traits that is far more common in violent criminals than in the general population and is a strong predictor of repeat offenses. Given the crime and other societal costs caused by psychopathic individuals, Kiehl says, this group has been woefully understudied. He intends to change that. With a custom-built mobile magnetic resonance imaging (MRI) scanner—roughly \$2.3 million of equipment packed into a 15-meter-long trailer—and permission from the New Mexico governor to work in all 12 state prisons, Kiehl aims to scan 1000 inmates a year.

“We’ll have to see if he gets that much done, but if anybody can do it, Kent can,” says Joseph Newman, a psychologist at the University of Wisconsin, Madison. “He has big ideas, and he pursues them energetically.”

Kiehl’s team conducts hours of interviews with each subject to assess them for psychopathy, substance abuse, and other mental

health problems. In addition to functional MRI (fMRI) experiments to investigate neural activity during various tasks, they’re also collecting anatomical images of the brain and DNA samples that could eventually be used to search for genetic risk factors—all with the prisoners’ full consent and cooperation and all to be used solely for research. Kiehl’s research is funded by four R01 grants from the National Institutes of Health, which pay about \$900,000 a year in direct costs; MRN paid for the scanner.

Depending on what he finds, Kiehl’s work could raise a host of legal and ethical questions. Could brain scans or blood tests one day improve on the personality profiles and other low-tech methods now used to assess the degree of risk a prisoner poses to society? If so, how should they be used? Could a better understanding of the psychopathic brain alter the way we think about the culpability of certain criminals? Could it point the way to interventions that prevent recidivism?

We’ll never know unless we do the research, Kiehl says: “We just have no idea how their brains are different, how they got that way, and how we might be able to treat the condition.”

Local boy does bad

Kiehl’s interest in psychopathy goes back to his childhood. He grew up in a middle-class neighborhood in Tacoma, Washington, not

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far from the boyhood home of serial killer Ted Bundy. While Kiehl was in grade school, Bundy was on a nationwide rampage, killing dozens of young women. Kiehl's father was a newspaper editor at the time, and Bundy's exploits were a common topic of discussion at the family dinner table.

Bundy exhibited several defining traits of psychopathy. He was cunning and manipulative, often donning disguises or feigning injury to lure women into a vehicle, and his preferred method of killing—crowbar blows to the head—as well as his proclivity for sex with his dead victims suggest a stunning lack of empathy. “Why would someone from my neighborhood end up being so bad?” Kiehl remembers wondering at the time.

By the time Bundy was executed in Florida in 1989, Kiehl was fantasizing about becoming a professional athlete. He entered the University of California (UC), Davis, that year after being recruited to play on the football team. Solidly built at 6'2", Kiehl still exudes an athlete's self-confidence. On a recent afternoon, he collected on a \$100 bet with his lab manager over how far he could hit a golf ball. “I bet I could hit a ball farther than Tiger Woods,” he boasted.

When a knee injury forced Kiehl to reconsider his life goals, he recalled his fascination with Bundy and began getting more interested in neuroscience. He rotated through the laboratories of several UC Davis neuroscientists, setting his sights on graduate work with psychologist Robert Hare at the University of British Columbia (UBC) in Vancouver, Canada. Hare is a preeminent psychopathy researcher who in 1980 published the first version of what has become the main tool for diagnosing psychopathy. In its current incarnation, the Psychopathy Checklist-Revised (PCL-R) scores subjects on 20 traits indicative of psychopathy, including callousness, impulsivity, and a history of behavioral problems. People in the general population typically score a four or five on the 40-point scale, Hare says. A score of 30 is widely used as a benchmark for psychopathy.

Psychopathy is not listed in the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. (*DSM-IV*). The *DSM-IV* diagnosis of antisocial personality disorder captures some of the external manifestations of psychopathy, including impulsivity and antisocial behavior, but ignores personality traits such as glibness, callousness, and lack of remorse that are

scored by the PCL-R. Studies with prison populations have found that roughly 20% (slightly more or less, depending on the security level of the prison) of inmates qualify as psychopaths. Incarcerated psychopaths have committed an average of four violent crimes by the age of 40, Kiehl says. More than 80% of those who are released from prison commit another crime, usually a violent one, within 3 years, compared with 50% for the overall prison population. “Psychopathy is the single best predictor of violent recidivism,” says Kiehl, who hoped to collaborate with Hare to study the brains of psychopathic criminals.

But Hare wasn't interested in taking him on. “I had a lot of really outstanding students applying to work in my lab, and his grades weren't particularly great,” Hare says. Not one to give up easily, Kiehl launched a campaign that included a barrage of recommendation letters from UC Davis faculty members; he also drove through a snowstorm from Tacoma to Vancouver to hand-deliver a few bottles of California wine that he knew Hare would appreciate. “That did it,” says Hare. “He wore me down.”

An emotional problem?

Long before fMRI scanners came along, researchers suspected that psychopathy springs from a defect in emotional processing in the brain. Several of the disorder's signature traits hint at this, as do early studies that found blunted physiological responses—by measures such as heart rate and skin conductance—to emotionally evocative photographs in psychopaths.

Such abnormalities cast obvious suspi-

cion on the amygdala, the hub of emotion in the brain. In the first fMRI study of psychopathy, published in 2001 in *Biological Psychiatry*, Kiehl and UBC colleagues found reduced amygdala activity in psychopathic criminals compared with nonpsychopathic criminals in response to emotionally charged words. A malfunctioning amygdala is likely to be one crucial factor in psychopathy, says James Blair, a cognitive neuroscientist at the National Institute of Mental Health in Bethesda, Maryland. Human and animal studies have shown that the amygdala is essential for learning to avoid behaviors with unwanted outcomes, he notes. By preventing children from learning to avoid actions that harm other people, faulty wiring in the amygdala could derail normal social development and contribute to the callous, unemotional traits seen in psychopaths, he proposes. In the June issue of *The American Journal of Psychiatry*, his research group reports that children with callous, unemotional traits have less amygdala activity than other children when viewing photos of fearful facial expressions.

Other researchers question whether the amygdala is really the source of the problem, however. Newman, for example, has long argued on the basis of behavioral evidence that deficits in regulating attention may be the central issue for psychopaths. “Once they start paying attention to some goal they want, they ignore cues that would otherwise activate the amygdala,” he says.

Kiehl takes an even broader view. He suspects that psychopathy involves disruptions to a network of “paralimbic” regions in the brain's temporal and frontal lobes that contribute to emotion, attention, decision-



Lofty goals. Kent Kiehl, shown here at the top of Mount Shasta, plans to study the brains of 1000 inmates a year with his mobile MRI scanner.

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making, and other cognitive functions. Resolving some of the confusion about which cognitive processes—and which brain regions—are dysfunctional in psychopathy is a major goal of his neuroimaging work in New Mexico.

But neuroimaging has limitations (*Science*, 13 June, p. 1412). The behaviors that can be studied inside an fMRI scanner, for example, are necessarily simplified and artificial. Proving that any given neural abnormality that shows up in imaging actually contributes to psychopathic traits and behavior in real life is never easy, says Adrian Raine, a clinical neuroscientist at the University of Pennsylvania. And then there's the chicken-and-egg problem. "Is it leading a violent, psychopathic way of life that causes the structural and functional impairments we find, or is it the other way around?" Raine asks. "It's going to be hard to answer that very important question."

Prison-bound

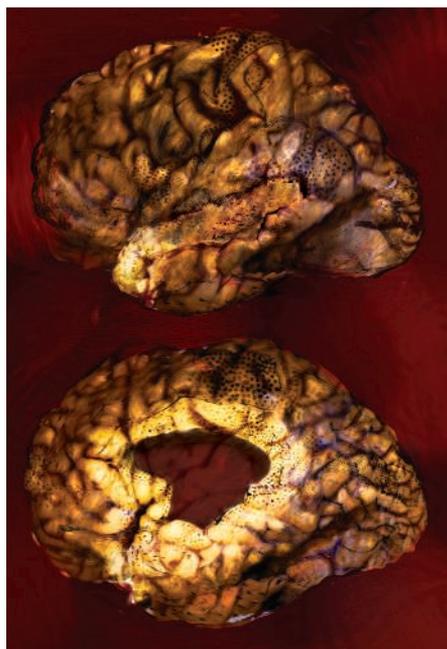
On a blazing hot day in late July, Kiehl's mobile scanner was parked inside the gates topped with razor wire at the Youth Diagnostic and Development Center in Albuquerque. From the outside, the mobile resembles any trailer you'd see on an 18-wheeler, albeit cleaner than most. Kiehl spent a year working with engineers at Siemens to design it and ensure that the scanner's magnetic field would remain stable in different locations. Inside, the mobile looks like an ultra-high-tech recreational vehicle. The scanner sits at one end, its magnetic cylinder a pale blue doughnut extending from floor to ceiling. Flat-screen monitors adorn the walls in the adjacent control room, and next to that a small sitting room contains a stack of magazines for the benefit of a corrections officer who waits here while a juvenile prisoner gets scanned.

All experiments are off-limits to the media, in part because of concerns about the privacy of prisoners but largely because of a bad experience Kiehl had in Canada. A television network broadcast an interview with one of his research subjects that was edited to make the guy seem even scarier than he was, Kiehl says. When the inmate was denied parole a short time later, he threatened to kill any other inmates who participated in Kiehl's research; he also threatened to hit Kiehl with a chair. Now Kiehl says he won't jeopardize his staff by allowing the media to watch experiments or interview inmates.

Despite the nature of some of their subjects' crimes, Kiehl's students and postdocs say that they've never felt threatened. "They

tend to really like us," says postdoc Matthew Shane. "They enjoy any excuse to talk with someone from outside the prison."

In one of the first studies using the mobile scanner, Kiehl's postdoc Carla Harenski and colleagues investigated how the brains of adult male prisoners respond to morally charged photographs, such as an image of a man holding a knife to a woman's throat. The inmates also rated the severity of the "moral violation" depicted in the photographs on a five-point scale. Those who gave high scores, suggesting greater sensitivity to moral violations, tended to have more activity in the superior temporal sulcus, a region implicated in previous studies of moral judgments, the researchers reported at an April meeting of



Neural roots. Kiehl suspects that disruptions to paralimbic brain regions (light areas) underlie psychopathy.

the Cognitive Neuroscience Society. The team has subsequently scanned a bigger sample of prisoners and is investigating whether activity in this and other brain regions differs between those who are psychopathic and those who aren't.

Into the courtroom?

Such differences in brain activity within prison populations could potentially prove useful in assessing the risk posed by individual criminals, perhaps as a supplement to the PCL-R, Kiehl says. That checklist is currently used in dozens of countries. Depending on the jurisdiction, PCL-R scores are considered during sentencing and parole hearings. Some prisons use them, along with

other factors, to determine security measures and treatment options.

Whether brain scans will ever prove useful in such settings depends on whether they add any predictive power, says Walter Sinnott-Armstrong, a philosopher at Dartmouth College and co-director of the MacArthur Foundation's Law and Neuroscience Project in Hanover, New Hampshire. Not everyone is optimistic. "It's not some sort of crystal ball that's going to tell you who's going to reoffend in 5 years' time," says Essi Viding, a cognitive neuroscientist at University College London. She also questions the practicality of the approach, given that MRI scans cost \$1000 or more apiece and require substantial technical expertise. Even so, research on the neural basis of psychopathy could have important legal implications, says Sinnott-Armstrong. For example, he says, if future research points to a diminished moral capacity due to a neurodevelopmental defect, that could be relevant in court, where a defendant's understanding of the wrongfulness of his actions has a bearing on the verdict.

Kiehl gets impatient with such hypotheticals. For him, the ultimate question is how best to intervene—ideally, early in life before psychopathic traits become ingrained. The conventional wisdom is that psychopathy is untreatable, but that's based "more on clinical lore than solid research," says Michael Caldwell, a psychologist at the Mendota Juvenile Treatment Center and the University of Wisconsin, Madison. One widely cited study found that psychopaths who participated in a treatment program in the 1970s actually did worse than those who didn't, Caldwell says. But given that the treatment regimen involved nude encounter groups and LSD, those findings should perhaps be taken with several grains of salt. Kiehl says he's been buoyed by a recent series of papers by Caldwell and colleagues that suggest that targeted interventions, including cognitive behavioral therapy and family counseling, with juvenile offenders with psychopathic traits can prevent future crimes.

Caldwell, Newman, and other veteran psychopathy researchers say that they're encouraged to see Kiehl's project getting off the ground because public support and funding for psychopathy research has been hard to come by in the past. "If someone is cruel and always out for himself, it's not something that engenders sympathy, concern, and the desire to understand it," says Newman. "My view is that it's a really important disorder that needs to be understood." Kiehl says he couldn't agree more.

—GREG MILLER