

NEUROSCIENCE

Brain Scans of Pain Raise Questions for the Law

PALO ALTO, CALIFORNIA—Ready or not, neuroimaging is knocking on the courthouse door. Last summer, Sean Mackey, a neurologist who directs Stanford University's Pain Management Center, was asked by defense lawyers in a workers' compensation case to serve as an expert witness. A man who received chemical burns in a workplace accident was seeking compensation from his employer, claiming that the accident had left him with chronic pain. The evidence his lawyers assembled included functional magnetic resonance imaging (fMRI) scans of his brain that showed heightened activity in the "pain matrix," a network of brain regions implicated in dozens of studies on the neural basis of pain.

But do those scans, taken while technicians gently brushed his afflicted arm or asked him to squeeze a rubber ball, prove that the man was experiencing the agony he claimed? Hardly, says Mackey, who uses fMRI in his own research. The worker may well have had a valid case, Mackey says, but the fMRI findings weren't relevant. Although certain brain regions consistently rev up when people experience pain, neuroscientists have yet to demonstrate that the converse is true: that any particular pattern of brain activity necessarily indicates the presence of pain. "I'm of the strong opinion that in 2008, we cannot use fMRI to detect pain, and we should not be using it in a legal setting," he said here last month.

This particular case did not go to trial: The two sides reached a settlement, says Mackey, who spoke at a Stanford Law School event that brought together neuroscientists and legal scholars to discuss how the neuroimaging of pain potentially could be used—or abused—in the legal system. The general consensus seemed to be that although the science is still emerging, the possibility of legal applications is very real, as Mackey's experience shows.

The intersection of neuroscience and the law has generated a buzz recently, both

among experts and in the popular media. Much of the attention has focused on using fMRI and other methods for lie detection. But Adam Kolber, a law professor at the University of San Diego in California, argued here that pain detection is more likely to be the first fMRI application to find widespread use in the courtroom, in part because the neuroscience of pain is better understood. Kolber estimates that pain is an issue in about half of all tort cases, which include personal injury cases. Billions of dollars are at stake. Yet people with real pain are sometimes unable to prove it, and malingerers sometimes win cases by faking it.

Using fMRI as a painometer isn't straightforward, however. For starters, said Katja Wiech, a cognitive neuroscientist at University College London, pain sensitivity varies considerably from one person to the next. It's also influenced by psychological factors such as anxiety (which tends to make pain worse) and attention (focusing on pain makes it worse; distractions take the edge off). Such influences also show up in fMRI scans, Wiech said. Moreover, she and others noted that several studies have found broad overlap in the brain regions activated by real and imagined pain—something that could be exploited by plaintiffs with bogus claims.

A. Vania Apkarian, a neuroscientist at Northwestern University in Evanston, Illinois, was more optimistic. His group has found that activity in the medial prefrontal cortex and the right insula correlates well with pain intensity and the duration of chronic pain, respectively, in people with chronic back pain. "This is an objective measure of pain in these patients," Apkarian said. Based on these and other findings, he predicted that fMRI will be courtroom-ready sooner than others had suggested. "Maybe not in 2008, maybe in 2012," he said. "It's inevitable."

Apkarian's data looked promising to several legal experts in attendance. "You

scientists care more about causation than we do in the law," said Stanford law professor Henry "Hank" Greely. "If the correlation is high enough, ... we would see that as a useful tool." Indeed, Greely and others noted, even if fMRI can't provide a perfectly objective measure of pain, it may still be better than the alternatives. "We let people get on the stand ... and say all kinds of things that may or may not be true," said William Fletcher, a judge on the U.S. Court of Appeals for the Ninth Circuit.

"There's absolutely no doubt that lawyers will become aware of this [neuroimaging evidence] and push for it," said Stephen Easton, a former trial lawyer and professor at the University of Missouri School of Law. Easton is concerned that fMRI images, like other types of visual evidence, could unduly sway juries. "Pictures can have an aura of objectivity beyond which is justified," he said. Indeed, a handful of recent studies have hinted that non-experts rate articles about human behavior as being more convincing when they're accompanied by irrelevant images of the brain (*Science*, 13 June 2008, p. 1413).

That's an important consideration, said law professor David Faigman of the University of California Hastings College of the Law in San Francisco. According to rule 403 of the Federal Rules of Evidence, judges can disallow relevant evidence if they deem it likely to mislead or prejudice the jury. Rule 403 has been invoked to exclude evidence from polygraph tests, Faigman said, on the grounds that the general public sees the tests as a more valid means of lie detection than they really are. He thinks the same logic could apply to neuroimaging evidence as well.

The verdict is still out, then, on how and to what extent the neuroimaging of pain will enter the legal system. But the opening arguments are already being heard. —GREG MILLER

