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Brain Signature Reveals Our Level of Pain

by Helen Shen on 10 April 2013, 5:00 PM | [3 Comments](#)

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A thermometer is great for measuring a fever, but when it comes to pain, doctors must rely on the age-old question, "How bad is it?" Scientists have long struggled to find physiological signs that can reliably tell "ouch" from "@#%!" and everything in between. Now, a brain scanning study suggests that painful heat excites a specific pattern of neural activity that could hold the key to better diagnosis and treatment of all kinds of pain in the future.

Functional magnetic resonance imaging (fMRI) studies have shown that certain areas of the brain—including the anterior cingulate cortex, somatosensory cortex, and thalamus—activate when people experience pain. But those same regions also light up in response to other experiences, such as painful thoughts or social rejection. In recent years, scientists have looked for a [particular pattern of activity across these areas that single out the experience of physical pain](#). "What we're evolving towards is trying to predict quantitatively from patterns of brain activity how much an individual is feeling," says Tor Wager, a neuroscientist at the University of Colorado, Boulder.

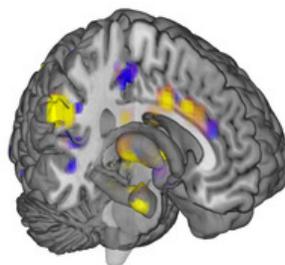
In the new study, Wager's group performed fMRI brain scans on a total of 114 healthy participants while delivering different amounts of heat to the volunteers' arms with a computer-controlled hot plate. In an initial experiment, the scientists used data from 20 people to find a brain-wide pattern of excitation and inhibition—a neural "signature"—that changed reliably as people experienced varying degrees of heat, ranging from painless to scalding. In the remainder of the study, Wager and his colleagues were able use the signature derived from the first group to predict pain responses in a completely different set of subjects—a promising sign for one day using such a model on patients suffering from unknown conditions, he says.

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The strength of the signature response scaled with increasing temperatures and correlated well with each person's reports of increasing pain as researchers cranked up the temperature from a toasty but painless 44.3°C to a scalding 49.3°C—akin to a hot cup of coffee, Wager says. Based solely on the intensity of the signature, [the team could distinguish whether participants had experienced painful heat or nonpainful warmth](#) with 93% accuracy. The neural reading could also predict which of two painful temperatures hurt more for the subjects, as reported today in *The New England Journal of Medicine*.

When participants received a pain-relieving chemical called remifentanyl, the signature response subsided—even during trials in which people believed that they had received a placebo. The volunteers did not show the pain

[ENLARGE IMAGE](#)



A look of pain. Brain scans reveal a telltale pattern of activity that signals whether someone is feeling pain and how much it hurts.

Credit: Tor Wager

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signature response while anticipating a painfully hot sensation or remembering a previous bout of pain. Those responses were also notably absent as people viewed photographs of their recent exes, a painful social experience that activates some of the same brain areas as physical pain.

"This paper is a quantum leap for the field of imaging pain and hopefully the basis for other groups to go forward," says David Borsook, a pain specialist at Boston Children's Hospital and Harvard Medical School. He predicts that brain scans could one day help doctors track patients' symptoms as they try different treatments or assist researchers in comparing the efficacy of experimental pain drugs.

For now, more work is needed to determine how well Wager's methods can distinguish other kinds of pain such as dull, throbbing aches and stabbing pains, says Robert Coghill, a neuroscientist at Wake Forest University in Winston-Salem, North Carolina. "We need some really hard evidence," that the tests can be used broadly, but he says this study makes a good start. "It's definitely a tour de force."

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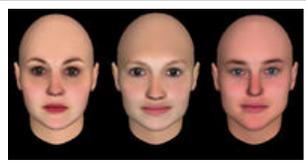
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Dr Colossus · 2 months ago

If the doctor asks "how much does it hurt, from 1-10? and 10 is the worst pain you can imagine", you have no idea what to say since that puts a number on something very subjective. "Well its certainly not 10, so 5" but in fact it was 7, and they should give you morphine. A real way to estimate this would be useful.

^ | ▾ Reply Share ›

SlipperyLinda · 2 months ago

Lost me at Hot Plate ... how about actual pain?

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thomas w · 2 months ago

I think this will lead no where. Just like a good lie detector led no where. The U.S> is evil. As such; pain and misery are part of the program.

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