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# Hurts so good: Chronic pain changes brain response to acute pain

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New research reveals why a stimulus that healthy human subjects perceive as a reward might be processed quite differently in the brains of humans suffering from chronic pain. The study, published by Cell Press in the April15 issue of the journal *Neuron,* provides fascinating insight into an apparent switch in neural circuitry that may be an integral part of the pathophysiology of chronic pain.

Pain is commonly described on a subjective level, but it can also be characterized by the behavioral response it elicits, such as the motivation to escape. "Although much is known about the brain areas that encode the subjective sensory properties elicited by painful stimuli, the complex circuitry involved in translating pain to motivated behavior remains unclear and minimally explored," says senior study author, Dr. A. Vania Apkarian from the Northwestern University Feinberg School of Medicine in Chicago.

Dr. Apkarian and colleagues used functional magnetic resonance imaging (fMRI) to compare brain activity in response to acute noxious thermal stimuli in healthy control subjects and in patients with chronic back pain. The researchers found that pain perception and related brain activation patterns were nearly identical in the two groups. However, there was one profound difference in the activity of a specific part of the brain called the nucleus accumbens (NAc).

The NAc has been extensively researched with regards to its role in reward and motivation, but how it fits into circuitry underlying the

response to aversive events or chronic pain is not clear. In the current study, the researchers discovered that phasic NAc activity at the beginning of painful stimuli predicted pain perception and at termination of painful stimuli predicted reward (pain relief) in the healthy group. In the subjects with chronic back pain, NAc activity correlated with different neuronal circuitry than the controls, and its phasic activity at the end of the stimulus was in the opposite polarity than the healthy subjects, suggesting that the acute pain relieved the ongoing back pain.

"The psychophysical part of our study supported the hypothesis that the NAc signal difference between the two groups reflects differences in the predicted valuation of the offset of the acute painful stimulus; in chronic pain patients, it reflects the prediction of worsening the ongoing back pain, as if the patients were disappointed that the painful stimulus was discontinued, while in the control subjects it reflects the prediction of relief," explains Dr. Apkarian. "These findings point to a potential dysfunctional associative learning process in chronic pain patients."

**More information:** Baliki et al.: “Predicting Value of Pain and Analgesia: Nucleus Accumbens Response to Noxious Stimuli Changes in the Presence of Chronic Pain.” Publishing in Neuron 66, 149-160, April 15, 2010. DOI 10.1016/j.neuron.2010.03.002

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