Expectations of Pain: I Think, Therefore I Am: National Institute of Neurological Disorders and Stroke (NINDS)

Expectations of Pain: I Think, Therefore I Am

For release: Wednesday, February 15, 2006

While the theory that “mind over matter” exists is an ancient belief, the scientific studies to support this idea have remained elusive. A new study provides brain imaging evidence that positive thinking interacts with and shapes the sensory experience of pain. This study suggests that decreasing the expectation of pain can reduce both the pain-related brain activity and perception of pain intensity. This knowledge may lead to new and effective ways to manage chronic pain.

“Our data shows that what you *think* really changes what you *experience*,” says Robert Coghill, Ph.D. of Wake Forest University School of Medicine in Winston, Salem . “Positive thinking could be an important adjunct to managing chronic pain. The most effective treatment for patients suffering from chronic pain may be a combination of medicinal and psychological therapies.” The study was funded by the National Institute of Neurological Disorders and Stroke (NINDS), a component of the National Institutes of Health (NIH), and appears in the September 6, 2005, issue of *Proceedings of the National Academy of Sciences**.

When expecting pain, we first form an active mental picture of the event that is about to happen. This picture is composed by incorporating past experiences with the current situation and what we believe will happen. Secondly, brain regions that are involved with the mental picture interact with the brain areas responsible for processing pain. As a result, the brain regions supporting the experience of pain are modulated by these predetermined expectations.

The new study focuses on this modulation of pain that is controlled by our expectations. The study uses functional MRI, a technology that shows which areas of the brain are activated during a task, to reveal the brain regions involved in the expectation of pain and the resulting experience. This is one of the first studies to look at pain perception through brain imaging techniques.

In the experiment, subjects participated in several sessions using a computer-controlled miniature heat pump to stimulate the sensation of pain. Researchers taught participants to expect three different levels of painful heat after different timed intervals. A seven-second interval signaled a heat level that caused mild pain, a 15-second interval signaled a heat level that produced moderate pain, and a 30-second interval signaled a heat level that produced severe pain. The heat stimuli were on for only 20 seconds and didn’t produce enough heat to cause burns or damage to the skin.

One or two days after training, participants underwent the fMRI testing during 30 different heat trials. During testing the researchers unexpectedly mixed the signals for the pain levels, so that participants were expecting one temperature, but actually received either a higher or lower temperature about 30 percent of the time. The researchers were able to see that levels of pain reported were reflected in the fMRI scans of the brain. People with decreased expectations for pain reported less pain. At the same time, activity decreased in areas of the brain important to both sensory and emotional processing of pain. These areas included the primary somatosensory cortex, the insular cortex and the anterior cingulate cortex. These lower expectations reduced reports of pain by more than 28 percent. “Expectations about pain can affect its intensity at a level of pain reduction that is comparable to that of a normal dose of the painkiller morphine,” says Dr. Coghill.

Many factors change the way that pain is perceived, and pain can be viewed as more intense or less intense depending on the situation. Different factors that can alter perception specifically when it comes to pain include how much attention is focused on the symptom. People also have different pain thresholds at which sensory nerves that carry pain information will send those signals. Some people need only a little stimulation in order for their nerves to send pain signals, while others need a much greater amount of stimulation. Future research in the lab will examine the brains of people with these different thresholds for pain.

This study shows that the nature of pain perception is different in each individual. Not only are there individual differences in the nervous system but also individual experiences contribute to how pain is perceived. The researchers are planning to use the fMRI technique to examine the effect of different personality types on pain perception. The study will examine how optimistic versus pessimistic personality types influences how people deal with pain and modulate pain processes in the brain.

“Pain needs to be treated with more than just pills,” says Dr. Robert Coghill. “The brain can powerfully shape pain, and we need to exploit its power."

The NINDS is a component of the National Institutes of Health within the Department of Health and Human Services and is the nation's primary supporter of biomedical research on the brain and nervous system. The National Institutes of Health (NIH) is comprised of 27 Institutes and Centers and is a component of the U. S. Department of Health and Human Services. It is the primary Federal agency for conducting and supporting basic, clinical, and translational medical research, and investigates the causes, treatments, and cures for both common and rare diseases. For more information about NIH and its programs, visit http://www.nih.gov.

*Koyama T, McHaffie JG, Laurienti PJ, Coghill RC. "The subjective experience of pain: Where expectations become reality." *Proceedings of the National Academy of Sciences*, September 6, 2005, Vol.102, pp.12950-12955.

-by Michelle D. Jones-London, Ph.D.

Date Last Modified: Wednesday, February 15, 2006