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Chronic pain harms the brain

CHICAGO -- People with unrelenting pain don't only suffer from the non-stop sensation of throbbing pain. They also have trouble sleeping, are often depressed, anxious and even have difficulty making simple decisions.

In a new study, investigators at Northwestern University's Feinberg School of Medicine have identified a clue that may explain how suffering long-term pain could trigger these other pain-related symptoms.

Researchers found that in a healthy brain all the regions exist in a state of equilibrium. When one region is active, the others quiet down. But in people with chronic pain, a front region of the cortex mostly associated with emotion "never shuts up," said Dante Chialvo, lead author and associate research professor of physiology at the Feinberg School. "The areas that are affected fail to deactivate when they should."

They are stuck on full throttle, wearing out neurons and altering their connections to each other.

This is the first demonstration of brain disturbances in chronic pain patients not directly related to the sensation of pain. The study will be published Feb. 6 in *The Journal of Neuroscience*.

Chialvo and colleagues used functional magnetic resonance imaging (fMRI) to scan the brains of people with chronic low back pain and a group of pain-free volunteers while both groups were tracking a moving bar on a computer screen. The study showed the pain sufferers performed the task well but "at the expense of using their brain differently than the pain-free group," Chialvo said.

When certain parts of the cortex were activated in the pain-free group, some others were deactivated, maintaining a cooperative equilibrium between the regions. This equilibrium also is known as the resting state network of the brain. In the chronic pain group, however, one of the nodes of this network did not quiet down as it did in the pain-free subjects.

This constant firing of neurons in these regions of the brain could cause permanent damage, Chialvo said. "We know when neurons fire too much they may change their connections with other neurons and or even die because they can't sustain high activity for so long," he explained.

"If you are a chronic pain patient, you have pain 24 hours a day, seven days a week, every minute of your life," Chialvo said. "That permanent perception of pain in your brain makes these areas in your brain continuously active. This continuous dysfunction in the equilibrium of the brain can change the wiring forever and could hurt the brain."

Chialvo hypothesized the subsequent changes in wiring "may make it harder for you to make a decision or be in a good mood to get up in the morning. It could be that pain produces depression and the other reported abnormalities because it disturbs the balance of the brain as a whole."

He said his findings show it is essential to study new approaches to treat patients not just to

control their pain but also to evaluate and prevent the dysfunction that may be generated in the brain by the chronic pain.

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Chialvo's collaborators in this project are Marwan Baliki, a graduate student; Paul Geha, a post-doctoral fellow, and Vania Apkarian, professor of physiology and of anesthesiology, all at the Feinberg School.

For more information on Dante Chialvo visit: www.chialvo.net/index.html

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