Stimulation of deep brain structure may ease chronic pain

Electrical stimulation of a deep, middle brain structure could offer a drug-free alternative to the treatment of chronic pain, according to a new animal study.
The study, led by the University of Texas at Arlington (UTA), is published in the journal *Experimental Brain Research*.

There is an urgent need to find new ways to treat chronic pain without drugs. In the US, abuse of prescription opioid medicines has reached epidemic proportions and is linked to thousands of overdose-related deaths every year.
The new study shows how electrical stimulation of the ventral tegmental area – a deep brain structure underneath the cortex that is normally associated with reward and drug abuse – may treat pain by addressing pathways that affect both the sensation and the perception of pain.

The technique, which uses a wireless device to deliver the electrical stimulation, also triggers the release of dopamine, which may help reduce the distress that often accompanies long-term pain, say the researchers.

One of the senior investigators, Yuan Bo Peng, a professor of psychology at UTA, says theirs is the first study to use a wireless device to ease pain through direct electrical stimulation of the ventral tegmental area. He adds:

“While still under laboratory testing, this new method does provide hope that in the future we will be able to alleviate chronic pain without the side effects of medications.”

**Sensation and perception**

Pain is a complex, subjective experience, and it is thought to comprise two related, but distinct mechanisms: sensation, which relates to the signals that the body produces in response to a physical stimulus, and perception, which relates to the way the sensations are interpreted to produce pain.

Researchers also talk about the link between “nociception” and pain. Nociception – the sensing of potential harm – is where the central nervous system processes signals generated by “nociceptors” as a result of tissue injury, for example.
The potentially harmful signals in the central nervous system are controlled by the body’s own pain inhibitors – such as opioids and other substances – through pathways to and from the brain. There is also a view that the spinal cord contains mechanisms for stopping pain-related information reaching the brain.

Thus pain is the result of higher brain processing, whereas nociception can arise in the absence of pain.

In their study, the researchers tested their patented custom-designed wireless device on rats.

They showed that electrical stimulation of the ventral tegmental area (VTA) reduced the sensation of pain by increasing nociceptive thresholds, and by blocking pain signals in the spinal cord, effectively reduced the perception of pain.

The study marks 10 years of collaboration between Prof. Peng and the other senior study investigator, J.C. Chiao, an electrical engineering professor at UTA.

Prof. Chiao has constant pain from slipped discs and pinched nerves, and his uncle also encountered chronic pain following chemotherapy for prostate cancer. His uncle was fitted with an early design of an implant to electrically stimulate his spinal cord to relieve pain.

However, while that device was the best available, it had to be manually adjusted every 15 minutes, causing Chiao’s uncle much loss of sleep before he passed away.

Since then, Profs. Peng and Chiao, along with colleagues from various
disciplines, have been working to develop more advanced, wireless technology that can treat pain in the background, while patients get on with their lives.

Prof. Peng concludes:

“Until this study, the ventral segmental area of the brain was studied more for its key role in positive reinforcement, reward and drug abuse. We have now confirmed that stimulation of this area of the brain can also be an analgesic tool.”

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