Research team identifies gene mutation that causes loss of pain perception

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Nurse gives injection to woman, New Orleans, 1941. Credit: Wikipedia.

(Medical Xpress)—A large team of European researchers has identified a gene mutation that is responsible for causing a condition that leads to an inability to experience pain in humans. In their paper published in *Nature Genetics*, the team describes how they compared the genes of a

girl incapable of feeling pain, with the genes of her parents, who do feel pain, and found the gene that was different between them.

People feel pain as a result of excitation of nociceptors—neurons in the skin and other parts of the body that transmit sensory information. The gene the team found is responsible for causing the development of what are known as SCN11A channels. Nociceptors have three such channels, SCN9A, SCN10A and SCN11A. Each works by serving as a passageway for sodium ions that make their way (carrying pain information) to the spinal cord and eventually the brain. Prior research has found that problems with SCN9A, SCN10A can lead to insensitivity to pain because they cannot transmit the sodium ions. This new research suggests the mutation with SCN11A works in the opposite way—causing too much stimulation to the neuron resulting in a road-block of sorts, preventing the ions from passing through.

The researchers report that they enlisted the assistance of an unidentified girl who was born with an inability to feel pain—a condition that generally leads to multiple injuries as situations that cause injury cannot be felt. Such people they report, tend to burn themselves, experience lacerations and engage in activities that result in broken bones. By comparing the genes of the girl with her parents, who both experience pain in the normal sense, the team was able to pinpoint the gene that was responsible for the condition in the girl—a mutation that caused SCN11A channels to form incorrectly.

To show that the gene they'd found was the actual culprit, the team caused changes to the same gene in test mice then watched how they behaved. The changed mice began to experience injuries very similar to people who cannot experience pain, supporting their belief they'd found the right gene. In testing with the mice, the researchers found one significant difference—the changes to the gene responsible for creation of SCN11A channels didn't appear to cause complete cessation of

sensations—only partial.

Identifying the right genes in humans, the team suggests, may lead to the development of new types of analgesics that can temporarily halt the sensation of pain entirely—a development that would have a profound impact on people who experience pain, regardless of the source.

More information: A de novo gain-of-function mutation in SCN11A causes loss of pain perception,

Abstract
The sensation of pain protects the body from serious injury. Using exome sequencing, we identified a specific de novo missense mutation in SCN11A in individuals with the congenital inability to experience pain who suffer from recurrent tissue damage and severe mutilations. Heterozygous knock-in mice carrying the orthologous mutation showed reduced sensitivity to pain and self-inflicted tissue lesions, recapitulating aspects of the human phenotype. SCN11A encodes Nav1.9, a voltage-gated sodium ion channel that is primarily expressed in nociceptors, which function as key relay stations for the electrical transmission of pain signals from the periphery to the central nervous system. Mutant Nav1.9 channels displayed excessive activity at resting voltages, causing sustained depolarization of nociceptors, impaired generation of action potentials and aberrant synaptic transmission. The gain-of-function mechanism that underlies this channelopathy suggests an alternative way to modulate pain perception.