Pain sensitivity may be influenced by lifestyle and environment, twin study suggests

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

Researchers at King's College London have discovered that sensitivity to pain could be altered by a person's lifestyle and environment throughout their lifetime. The study is the first to find that pain sensitivity, previously thought to be relatively inflexible, can change as a result of genes being switched on or off by lifestyle and environmental factors – a process called epigenetics, which chemically alters the expression of genes.

Published today in *Nature Communications*, the study has important implications for understanding pain sensitivity and could lead to new treatments aimed at 'switching off' certain genes epigenetically.

Identical twins share 100 per cent of their genes, whereas non-identical twins share on average only half of the genes that vary between people.

Therefore, any difference between identical twins must be due to their environment or epigenetic changes affecting the function of their genes, making them ideal participants for a study of this nature.

To identify levels of sensitivity to pain, scientists tested 25 pairs of identical twins using a heat probe on the arm. Participants were asked to press a button when the heat became painful for them, which allowed the researchers to determine their pain thresholds. Using DNA sequencing, the researchers examined over five million epigenetic marks across the whole genome and compared them with a further 50 unrelated individuals to confirm their results.

This is the first study to use large numbers of twins with such an in-depth examination of epigenetic signals.

The research team found wide variations between people and identified chemical modifications within nine genes involved in pain sensitivity that were different in one twin but not in her identical sister.

The chemical changes were most significant within a known pain sensitivity gene, TRPA1, already a therapeutic target in the development of painkillers (analgesics).

This is the first time TRPA1 has shown the capacity to be switched on and off epigenetically; finding out how this happens could have major implications for tackling pain relief. It is well established that people who are most sensitive to pain encountered in everyday life are more likely to go on to develop chronic pain.

Lead author of the study, Dr Jordana Bell, Department of Twin Research & Genetic

Epidemiology at King's College London, said: 'The potential to epigenetically regulate the behaviour of TRPA1 and other genes involved in pain sensitivity is very exciting and could lead to a more effective pain relief treatment for patients suffering with chronic pain.'

Tim Spector, Professor of Genetic Epidemiology at King's College London, said: 'Epigenetic switching is like a dimmer switch for gene expression. This landmark study shows how identical twins, when combined with the latest technology to look at millions of epigenetic signals, can be used to find the small chemical switches in our genes that make us all unique – and in this case respond to pain differently.'

More information: Paper: dx.doi.org/10.1038/ncomms3978

Provided by King's College London