# Can't stand the heat? Study reveals how we work out if we're too hot

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With temperatures soaring across the UK, our ability to detect and avoid places that are too warm is vital for regulating our body temperature. However, until now, little was known about the molecular mechanisms

responsible for detecting warmth in the sensory neurons of our skin.

A new King's College London study, published today in *Nature*, reveals that a gene called TRPM2 initiates a 'warm' signal in mice that drives them to seek cooler environments. When this gene is removed, the mice are unable to distinguish between cool and warm temperatures.

Some 'TRP' (Transient Receptor Potential) proteins were already known to be activated by painful levels of heat. These proteins can conduct positively charged ions across the cell membrane, and so can change the internal voltage of a nerve cell. This change in voltage in turn triggers nerve activity, and so signals the painful sensation of heat, such as from touching a hot kettle. However, previous research had not revealed ion channels which may be activated by milder levels of non-painful warmth.

Dr Chun-Hsiang Tan and Professor Peter McNaughton from King's College London identified an ion channel called TRPM2, which had not previously been linked to the sensation of warmth. Having isolated this novel sensory channel, they removed the TRPM2 gene in a group of mice and compared their behaviour to normal mice when walking across warmed surfaces at 33°C or 38°C. The researchers found that normal mice preferred a cooler temperature of 33°C and avoided the warmer temperature of 38°C, while the mice in which the TRPM2 gene had been deleted were unable to distinguish between the two.

Dr Chun-Hsiang Tan, a postdoctoral worker at King's College London, said: 'The removal of TRPM2 in these mice eliminated their ability to detect non-painful warmth, yet the capacity to detect painful levels of heat using other known receptors was unaffected. This reveals how we are able to detect environments that are too warm at a sensory level.'

Professor Peter McNaughton, also of King's College London, said: 'The

temperatures we examined are certainly comparable to those you might find on a London bus or tube carriage in the height of summer. At 38°C a busy tube carriage would be quite suffocating, so sensory neurons in our skin allow us to detect that the environment is too warm and drive us to take action - whether that be removing an article of clothing or alighting the tube and seeking a cooler environment.'

Professor McNaughton added: 'We have shown that TRPM2 is important for the conscious detection of warmth, but does it also play a role in the unconscious regulation of body temperature? In future studies it would be interesting to explore whether TRPM2 also plays an unconscious role in controlling our body temperature, by regulating sweating and the constriction of blood vessels in the skin.'

**More information:** The TRPM2 ion channel is required for sensitivity to warmth, *Nature*, DOI: 10.1038/nature19074

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