- Temperature / Brain

GLOBAL EYE

HEALTH

Warm and cool temperatures travel on completely different paths to the brain

WORDS PERRI THALER

In a first, researchers have revealed the complete sensory pathway that enables skin to communicate temperatures to the brain. It turns out that cool temperatures have an individual, dedicated pathway, suggesting that the body has different circuits for deciphering warmth and coolness. The study, published in the journal *Nature Communications*, is the first to map out the pathway for sensing colder temperatures, starting from the skin and ending in the brain. The research team traced this 'wiring diagram' in mice to better understand how cool stimuli on the skin get translated into information the brain can digest and react to. The same temperature circuits are likely found in humans, too, the researchers say. "This research represents an important shift in how we understand sensory perception," said Bo Duan, who studies molecular, cellular and developmental biology at the University of Michigan.

Previously, neuroscientists thought that all temperature sensations, from frigid to scalding, travelled on the same general pathway to the brain. This study shows for the first time that different parts of the temperature spectrum use different circuits to alert the brain. "This not only refines our understanding but also opens the door to entirely new lines of research into how our nervous system processes different kinds of sensory information," says Duan. The researchers used advanced imaging techniques, electrical monitoring of the heart, behavioural analyses and in-depth genetic data to determine how mice transmit the sensation of cooler temperatures from their skin to their brains.

The team observed specific sensors on the skin that are tuned to temperatures between 15 and 25 degrees Celsius, which are considered cool. These sensors excite sensory neurons when they're engaged, and the neurons then send signals to the spinal cord. There, the signals get amplified and passed along, ultimately activating neurons connected to the brain. In an experiment, the researchers disabled the cells responsible for this amplification in mice, specialised interneurons, and found that the rodents no longer reacted to cool temperatures. They also saw that these interneurons responded only to cool signals, not to warm or cold stimuli. "By uncovering how these signals are processed in the brain, our research helps build the foundation for protecting and improving this fundamental aspect of human health," Duan said.

Duan and the rest of the team now hope to understand how the newly discovered pathway interacts with other sensory circuits, like those for pain and itch. They also want to learn how disruptions in these systems might contribute to temperature sensitivities. "To answer these questions, we plan to use advanced imaging techniques and genetic tools to explore this pathway in even greater detail," Duan says. This type of work may be helpful for pain relief in the context of medical procedures. Some cancer patients undergoing chemotherapy, for example, experience cold allodynia, a condition that makes even mild coolness feel painful. "By understanding the specific circuit for cool sensation, we may be able to develop therapies that target this pathway to reduce such side effects," Duan suggested.

Did you know?
Nearly 60 per cent of the brain is made up of fat

Researchers have mapped out the neural pathway humans use to perceive cool temperatures, and it's separate from the one for sensing heat